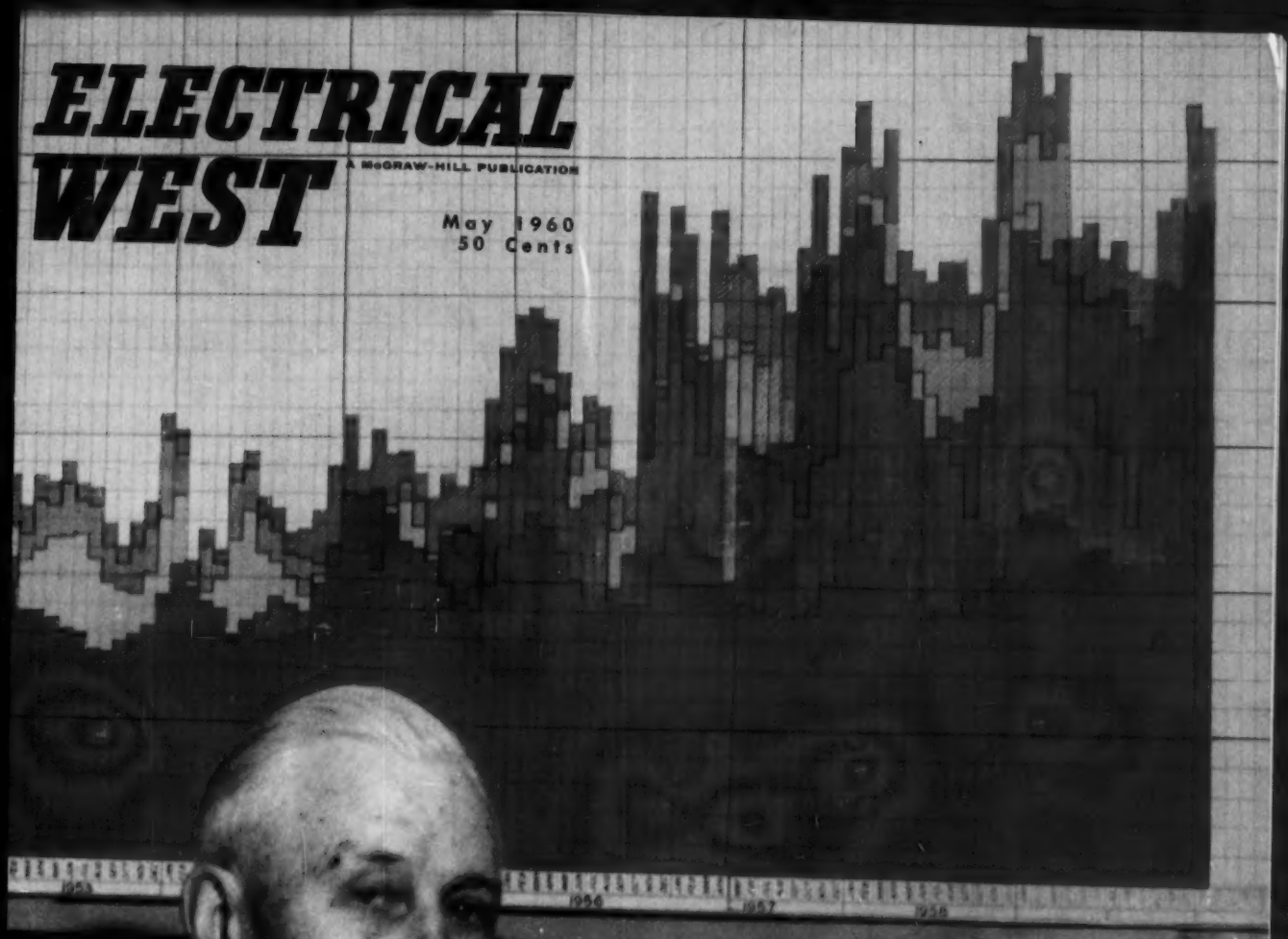
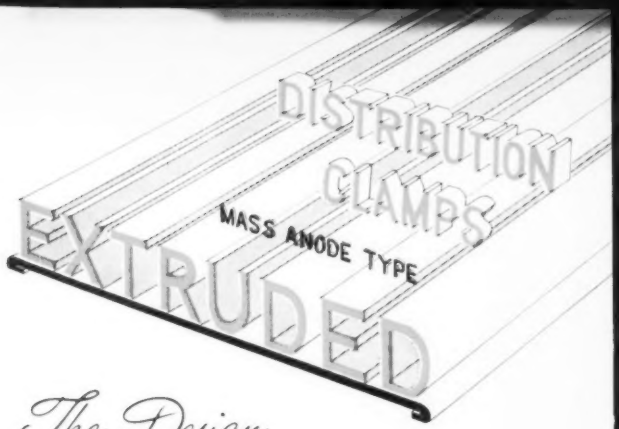
ELECTRICAL WEST

A McGRAW-HILL PUBLICATION

May 1960
50 Cents



Copco's John Boyle
Plans Pump Storage



The Design

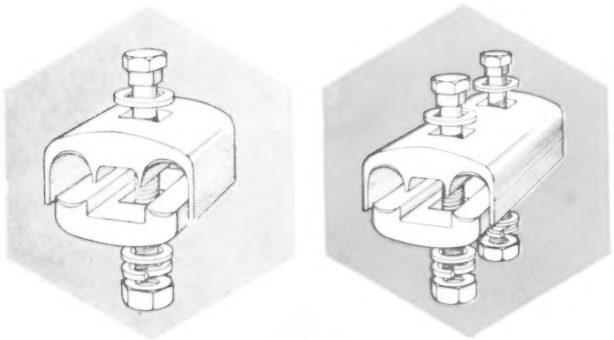
Body and bridge align themselves to contain and contact all strands. All conductor combinations, even one max. and one min., are contacted with pressures exerted in *exact* opposite directions (always toward the core). Conductors are never distorted.

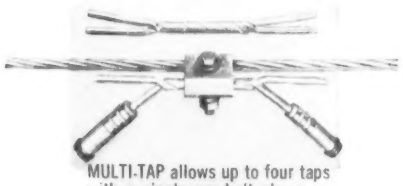
The Material

1. EXTRUDED ALUMINUM because conductivities are as tabled:

ALLOY	SUITABLE FOR	VOLUME CONDUCTIVITY (% International Annealed Copper Standard)
No. 6063 — Aluminum	Extrusions	55
No. 220 — Aluminum	Sand Casting	21
No. 356 — Aluminum	Die Casting	41
Alum Brz. (90 Cu., 8.9 Al., 1.0 Fe)	Casting	12.6
Copper Conductor	Draw	97
Aluminum Conductor	Draw	61-62

2. EXTRUDED ALUMINUM because shapes as designed are always true and the quality consistent.





MULTI-TAP allows up to four taps with a single one-bolt clamp on each conductor. Type of tap connector is optional

The Bolt

Galvanized Steel — Lubricated. Hex head permits use of two wrenches tightening against each other. Square shank allows use of only one wrench if necessary.

Types

One and Two Bolt — Four Sizes

LINE	TAP
1/0-8	1/0-8
4/0-2	4/0-2
336.4-1/0	336.4-1/0
336.4-1/0	1/0-8

HOT CLIPS, a reusable accessory, hold the line and tap sides ready for installation hot, using standard hot line tools.

The coefficient of linear expansion closely matches that of aluminum conductor, minimizing any ratcheting effect when brought through cycles of heating and cooling. The design of the clamp, based on the mass anode principle, reduces galvanic corrosion to insignificant proportions. This eliminates the need for copper liners for copper to aluminum connections.

Reliable

ELECTRIC COMPANY

Franklin Park, Illinois

A Symbol of Integrity Since 1903

AN ELECTRICAL WEST ACTION EDITORIAL

The Colorado Storage Project

Here are the facts concerning the private utilities'* transmission plans and how they relate to the Colorado River Storage Project.

1. The private utilities, recognizing the need for additional water in the area, have supported the Colorado River Storage Project since its inception. They agree that power production is a necessary adjunct to produce revenues to pay for the water development features.

2. They recognize that the law gives preference customers first call on project power, but have offered to buy surplus power to improve project financial feasibility.

3. The private utilities have worked jointly with the U. S. Bureau of Reclamation and the preference users to determine the best method of transmitting project power.

*Arizona Public Service Co., Public Service Co. of Colorado, Public Service Co. of N. M., Pacific Power & Light Co., Utah Power & Light Co.

4. Studies indicate that the load in the five-state area will increase 16 million kw by 1980. This increase is 15 times the total capacity of authorized project plants.

5. As a part of their plans to supply their portion of this load growth, the private utilities are planning to build approximately 2,000 miles of transmission system at a cost of $90 million which, in addition to its prime function of supplying private loads, can be used to distribute project power.

6. USBR would construct only 1,050 miles, costing $42 million, and would not duplicate existing or planned private lines.

7. Construction by the private utilities of the above facilities will be in consonance with their long-range transmission requirements. These facilities, together with the utilities' existing facilities and facilities to be constructed by the bureau, will provide the area with a wholly integrated transmission system interconnecting the power

Turn the page to find out how to use ELECTRICAL WEST'S action editorial

My dear Senator:

I have been associated with the electric power industry for ..... years.

Politically, I am a registered .....

My views with regard to a federal transmission grid tie are as follows:

.....

.....

.....

.....

I urge that you take the following stand in the forthcoming negotiations:

.....

.....

.....

Signed: .....

Title .....

Company .....

plants of the project with other federal plants and will be fully capable of marketing project power.

8. Under the utilities' plan, users of project power will have better electric service because the project plants will be connected to the large steam generating plants of the private utilities, thereby providing a firm power supply in low-water years.

9. The private utilities are presently wheeling for the USBR and have offered to wheel project power to preference customers at reasonable rates.

Conclusions

1. Use of private utility transmission would reduce federal construction expenditure by $90 million and increase federal, state and local taxes.

2. A market for Colorado River Storage Project power is assured with full protection of preference users' rights.

3. No duplication of transmission facilities with their attendant extra costs is necessary to provide firm service to preference loads.

4. Adoption of the private utilities' plan will permit accomplishment of full irrigation and reclamation benefits, the prime object of the project.

5. Utilities' plan accomplishes everything required by the authorizing act.

Here's How You Can Use This Action Editorial

1. State your opinions on this subject on the attached, return postcard. Sign your name and address. Put the card in the mail.

2. ELECTRICAL WEST will send the replies en masse to appropriate legislators for their information and consideration.

3. Mail the "Facts" section of this editorial to your local newspaper editor with your comments. You will find he will appreciate getting the inside story on this issue.

From: .....

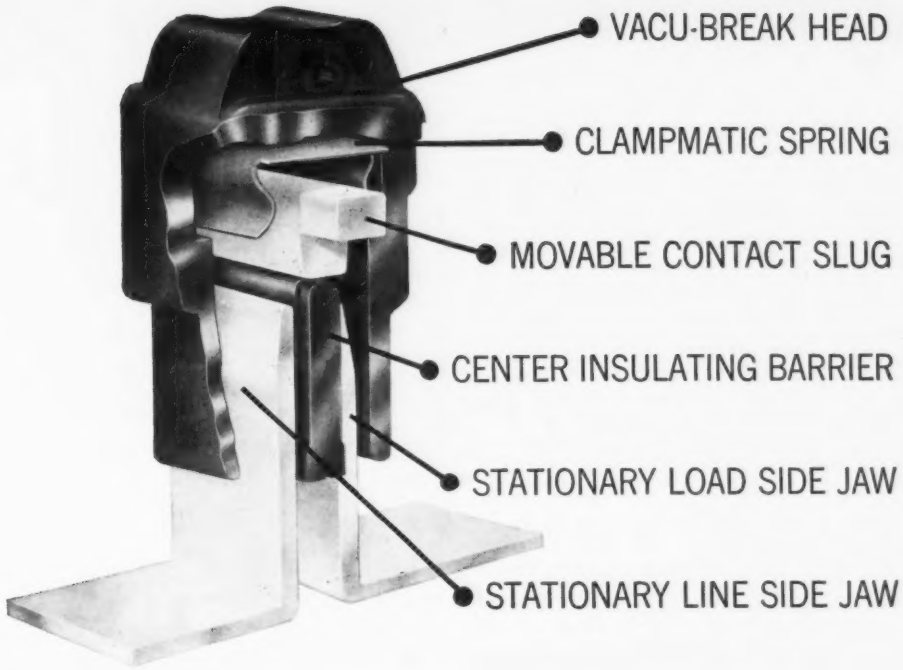
.....

.....

PUT 3¢ STAMP HERE

To: **Action Editorial**
Electrical West
68 Post Street
San Francisco 4, Calif.

Fill out other side and mail to ELECTRICAL WEST



INCREASE SAFETY SWITCH LIFE WITH CLAMPED PRESSURE CONTACT AND VACU-BREAK ARC CONTROL

Your customers get longer switch life from BullDog safety switches, thanks to unique BullDog design. The high-tension Clampmatic® spring puts pressure where it belongs—on contact faces after the switch is "ON." Clamped pressure action assures good electrical contact for the life of the switch. It means the switch lasts longer, too, for there's no overheating to damage switch components. In switching "OFF," the pressure's removed before the "break" . . . providing true quick-break action.

Vacu-Break® design is another reason BullDog safety switches last longer. Switching contacts are completely enclosed in the Vacu-Break head. Arcs are restricted, starved of oxygen, cooled and smothered quickly. In addition, Vacu-Break *double*-breaks the circuit, effectively reducing the arc length and arcing time.

Vacu-Break arc control plus clamped pressure contacts add up to long switch life . . . and dependable, economical service for your customers. You'll find BullDog safety switches need little or no maintenance over years of heavy-duty use. See your BullDog products distributor.

BullDog Electric Products Division, I-T-E Circuit Breaker Co., Box 177, Detroit 32, Mich. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., N.Y. 16, N. Y.

For Safety's Sake Buy Vacu-Break

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY

Consult the following Pacific Coast representatives:

Coast Electric & Manufacturing Co.
1733 N. E. Seventh Ave., P. O. Box 7712
Portland 12, Oregon

Safety Switchboard Company
910-89th Avenue
Oakland 21, California

Young Electric & Mfg. Co.
2134 Curtis St.
Denver 2, Colorado

BullDog Elec. Prod. Co. of Los Angeles
2885 E. Washington Blvd.
Los Angeles 23, California

Crapo

GALVANIZED STEEL STRAND HAS ALL 5

1. *Strength*
2. *Workability*
3. *Ruggedness*
4. *Long Life*
5. *Economy*

When you select a size and grade of strand for a specific job you want to know that it meets every requirement of that job. You want ample strength to sustain the ultimate load—plus an adequate safety factor. You want pliability for ease of working in the field. You want ruggedness to withstand the abuse which may be encountered during and after installation. You want long, dependable life. And, you want reasonably low first cost and low maintenance costs.

For more than 50 years *Crapo* Galvanized Steel Strand has consistently demonstrated its ability to more than meet all of these requirements. Proof of its reliable performance is to be found in the case histories of overhead power and communication lines throughout the country.

Crapo Galvanized Steel Strand is fully protected against corrosion by heavy, uniform, dense coatings of commercially pure zinc tightly bonded to the individual wires. All grades and sizes are available in A, B and C weights of coating.

For details, ask our distributor or write direct!

INDIANA STEEL & WIRE COMPANY, INC.
Muncie, Indiana

ELECTRICAL WEST

SPOKESMAN FOR THE MOST HIGHLY ELECTRIFIED REGION OF THE U. S. Established 1887

George C. Tenney, President
C. W. Leihy, Publisher — Jack Robinson, Editor
W. A. Cyr, Consulting Editor — Marvin Petal, Pacific Southwest Region
Peggy Boyer, Associate Editor — Frank Pitman, Intermountain Region
Miriam Stuart, Editorial Assistant — Ray Bloomberg, Pacific Northwest Region

CONTENTS

VOL. 124, NO. 5 MAY 1960

Copco Plans Pumped Storage by John Boyle 65
Hydro Kilowatts for $34 Each by A. L. Gustanoff 70
Telecomputing Equipment Tabulates Stream Flow by W. A. Lang 72
Water Supply Outlook by Homer J. Stockwell and J. Alden Wilson 74
Tester Ups Output 300% by Wayne J. Hunter 77
More Aluminum Substations Foreseen by C. E. Heenan 78
Berkeley Co-op First Luminous Supermarket 80
Proves Sales Theory About Lighting 83
Requirements of Starters by Tom Hughes 84

DEPARTMENTS

Construction News 81
Letters to the Editor 60
Meetings 19
Meetings Calendar 57
News 8
News Roundup 4
Product News 119
Advertising Index 128

The Cover—John Boyle, vice-president and general manager of California Oregon Power Co., who writes in this issue of Copco's plans for pump storage (see page 65)
Photo by Jack Robinson

ADVERTISING REPRESENTATIVES

ATLANTA 3: Robert Powell, Rhodes Haverty Bldg.; CHICAGO 11: W. C. McMurray Jr., 520 N. Michigan Ave.; PITTSBURGH 22: Don Farris, 1111 Henry W. Oliver Bldg.; DENVER 2: John Patten, 1700 Broadway, AL 5-2981; LOS ANGELES 17: Russ Antles, 1125 W. Sixth St., HU 2-5450; NEW YORK 36: Francis X. Roberts, 500 Fifth Ave.; SAN FRANCISCO 4: T. H. Carmody, Advertising Sales Manager, Bob McGinnis, Dick Alcorn, Bernice Johnston, Advertising Production Manager, 68 Post St., DO 2-4600.

Offices: Boston, Cleveland, Dallas, Detroit, Philadelphia, St. Louis

Electrical West (with which is consolidated The Journal of Electricity), May 1960, Vol. 124, No. 5. Published semimonthly except November when published trimonthly by McGraw-Hill Company of California, James H. McGraw (1860-1948) Founder. Office of publication, 235 N.W. Park Ave., Portland 9, Ore. See panel below for directions regarding subscriptions or change of address.

Executive, editorial, circulation and advertising offices: 68 Post St., San Francisco 4, Calif. Donald C. McGraw, chairman of the board; George C. Tenney, president; John W. Otterson, vice-president; Thomas H. Carmody, secretary and treasurer.

Position and company connection must be indicated on subscription orders. Send to address shown in panel below. Subscription price includes the regular monthly issue, the news letter issue and the November directory issue. United States subscription rate $3 a year, single copies 50c (November directory issue $1); Latin American Republics and Philippine Islands $4 a year; Canada $3.50 a year; all other countries $4 a year. Entered as second class matter, Dec. 17, 1956, at the post office at Portland, Ore., under the act of March 3, 1879. Printed in U. S. A. Title registered in U. S. Patent Office. © Copyright 1960, McGraw-Hill Company of California. All rights reserved.

SUBSCRIPTIONS: Send subscription correspondence and change of address to Subscription Manager, Electrical West, 68 Post St., San Francisco 4, Calif. Allow 30 days for change of address.

Postmaster: please send notice 3579 to Electrical West, 68 Post St., San Francisco 4, Calif.

SERIES ABS

"Sky-Master"

HYDRAULIC AERIAL BEAM

That's right, with the Series ABS Sky-Master workmen can reach out-of-the-way areas quickly and work on or near energized phase lines in complete safety.

Outer beam of the Series ABS is an extra-strong Spirex tube which withstands dielectric testing far in excess of normal requirements. Reinforced plastic work basket has no current-conducting parts or projections . . . provides ample work space and toe room for the operator.

Control levers beside work basket are connected to those on the mast by direct linkage, giving the operator a positive "feel" not possible with secondary hydraulic control-actuating systems.

Dielectric, reinforced plastic rods are installed in the control linkage and basket leveling mechanisms to electrically isolate the basket from the ground.

Modern way to work on energized high voltage lines

The Series ABS is fully-hydraulic in operation, powered by a pump driven by a power take-off on the truck transmission. Outer beam movement in an operating arc of 270 degrees and inner beam movement through a 110-degree arc is independently controlled. Mast can be rotated continuously in either direction. Safety devices prevent unwanted movement when controls are in neutral or if hydraulic system is damaged.

Maximum ground-to-basket floor height is 42′—enabling men to work safely and without fatigue up to 47′ above ground. Wide range of operation permits spotting of the work basket in limitless positions in any direction from the truck. The Series ABS, installed on a Powers-American Body that fits your work needs, can be furnished in two models; Series ABS-1-42 having one basket, Series ABS-2-42 with two baskets.

Another reason why
UTILITIES EXPECT MORE FROM

POWERS American

UTILITY BODIES AND EQUIPMENT

For descriptive literature and price information write . . .

McCABE-POWERS BODY COMPANY

5900 No. Broadway	625 Cedar Street	1461 E. Washington Blvd.	5525 S.E. 28th Ave.
ST. LOUIS 15, MO.	BERKELEY 10, CALIF.	LOS ANGELES 21, CALIF.	PORTLAND 2, ORE.

EW

news roundup

LONG CYCLE — Economic crystal-gazers queried by McGraw-Hill's Economics Department saw little prospect of a business downturn this year or next. In fact, they were split between cautious optimism and genuine enthusiasm over the prospects of pushing gross national product well above the $500 billion annual rate.

In another area the economists predict that research and development expenditures will increase from about a $12 billion annual rate in 1959 to about $22 billion per year in 1969. Expressed in constant 1959 dollars, this would represent about a 60% increase for the decade.

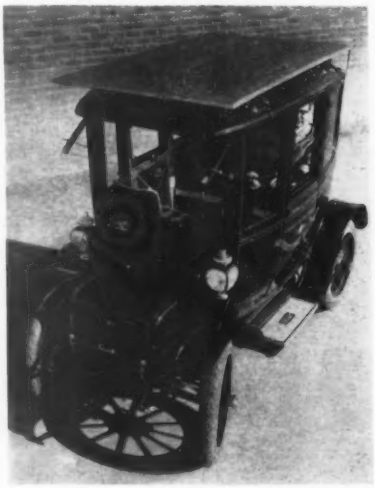
In still another region, marriages of the 18- to 24-year-old group will jump from 1.5 million annually to 2.2 million by 1969. This portends a long-time growth curve for housing starts, which are expected to move from the 1.1 million annual rate at the beginning of this year to about 2 million starts a year by 1970.

For those attending the PCEA convention at Las Vegas later this month, these trends will be charted out in George Tenney's address titled "New Forces in American Business."

TARGET MET—Since the end of World War II the country has built 680,000 school classrooms with a total of 1,330,000 now in use. The peak of the buildup has passed with future annual requirements tapering down from 50,000 classrooms a year to approximately 35,000 per year by the end of this decade. With half of the present-day classrooms of pre-World War II vintage, the estimated replacement rate is 16,000 per year. Looks like the school boards still will have a job ahead for many years.

COMPETITIVE GAMBIT — Straws in the wind indicate that more and more American manufacturers are producing components for equipment manufactured in the U.S. from overseas sources or subsidiaries. This country's electrical equipment manufacturers apparently are not immune from this tendency to meet foreign competition at its source. For example, Baldwin-Lima-Hamilton, the low bidder on eight turbines for the Glen Canyon project in Arizona, intends to process some of the parts overseas. Westinghouse President Mark Cresap told a stockholders' meeting in San Francisco that foreign components could not be ruled out as a future possibility even though such a move is against present company policy.

Meanwhile the pressure from foreign manufacturers continues to increase in the world market. Japanese electrical equipment manufacturers are becoming increasingly aggressive, winning orders for large electrical installations in Mexico, Australia and Formosa. The Mitsubishi Co. also was the apparent low bidder for 39 electric locomotives for the Panama Canal.



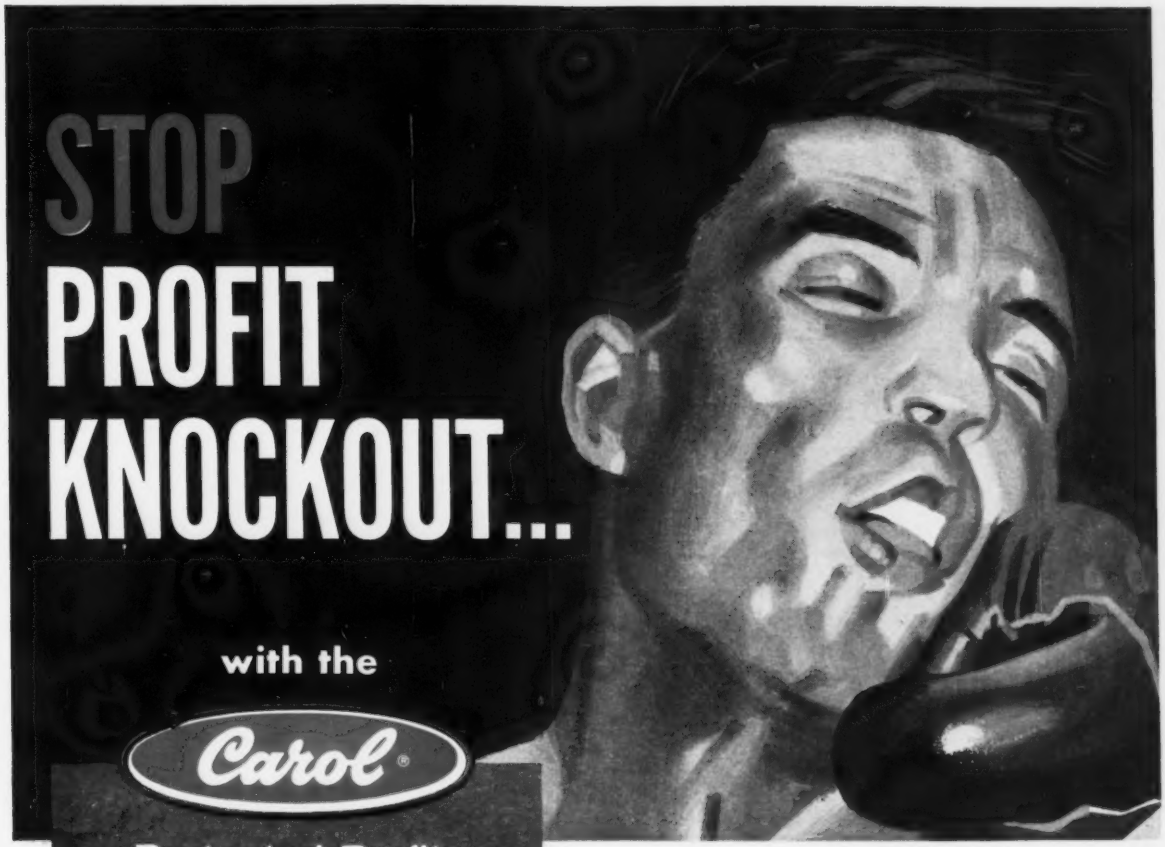
LOS ANGELES ANSWER TO SMOG — This sun-powered car, a renovated 1912 electric with detachable solar panels, recently made its debut in Los Angeles. The Solar King panel, made up of more than 10,000 individual silicon solar cells, can be mass produced for $2,000 to $3,000 according to Dr. Charles A. Escoffery, director of the project for International Rectifier Corp. of El Segundo, Calif. The detachable panel can be used for other purposes

NEW FRONTIER—Scientists at the University of California's Lawrence Radiation Laboratory are experimenting with pressures high enough to break down chemical bonds in some materials and produce new forms not found in nature. For example, iodine crystals subjected to 700,000 atmospheres change from an insulator into a metallic form that readily conducts electricity. Graphite, subject to similar pressures, was converted into diamonds momentarily—but they disintegrated because of the high temperatures involved. Other material, such as phosphorus, can be changed and remain stable new forms at normal pressure. While applications of this new knowledge seem somewhat remote, there might be future need for an electric switch made out of an insulator that would pass electrical current momentarily when subjected to shock. One thing is certain: most new knowledge seldom lies dormant for long.

REQUIRED COURSE — Educators should take note of a recent poll conducted by Pennsylvania State University. Of 325 companies queried, 70% now have computer facilities and indicate preference for college graduates having some training in their use. The companies indicated that they would require computer experts in all phases of company operations from accounting to research and all indicated that they had many jobs open that needed competently trained personnel or jobs that were filled now with inadequately trained people.

With the growth of computer applications, it may not be too long before a whole new curriculum with a bachelor in computing degree will be in order.

JUNE MEETINGS — Chronic conventioneers will have their work cut out for them in June when three of the industry's biggest meetings are scheduled. EEI will meet at Atlantic City for its 28th annual convention June 6-8. That meeting will be followed by the Summer General Meeting of AIEE, which also meets in Atlantic City June 19-24. In between



STOP PROFIT KNOCKOUT...

with the

Carol®

Protected-Profits Inventory Control Plan

When business is good—*but* your profits are taking it on the chin—just look at your inventory! Dead stock on your shelves—items that are obsolete or too slow-moving—knocks out profits every time.

Profits start with *buying*—the *right* merchandise . . . at the *right* price . . . in the *right* quantity . . . and with the *right* service and cooperation to insure rapid turnover.

That's why it'll pay you to know about the **Carol Protected-Profits Inventory Control Plan** . . . a newly developed service designed to:

- **Insure maximum turnover**
- **Eliminate obsolescence**
- **Insure adequate inventory to fill all orders promptly**
- **Insure balanced inventories**
- **Protect your profits**

STOP TAKING IT ON THE CHIN . . . Ask your Carol salesman for full details on the "Carol Protected-Profits Inventory Control Plan"—or write, wire or phone Carol Cable Company, Pawtucket, Rhode Island.

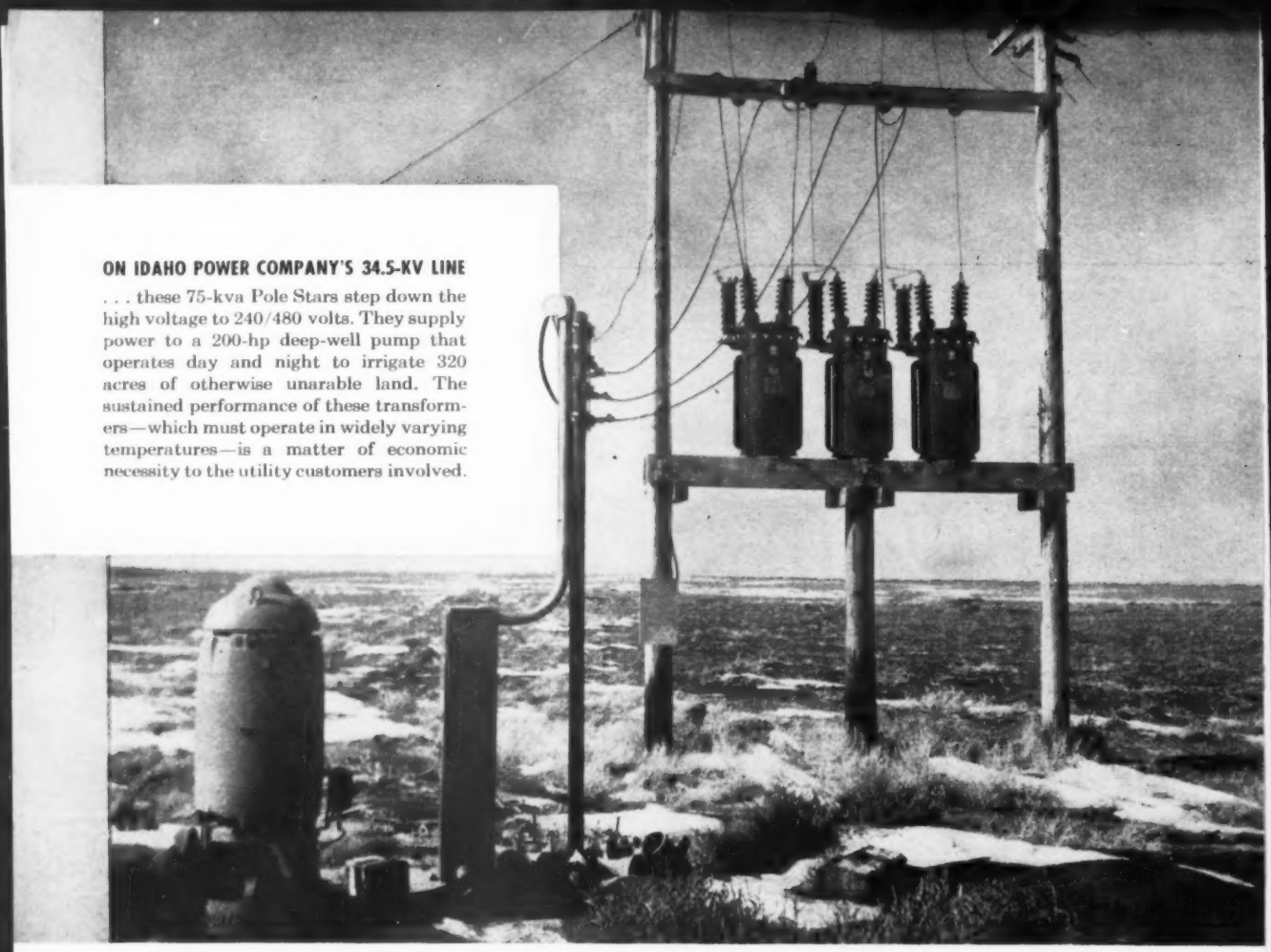
When you call for cable—call for Carol!

Portable Cords • Power Supply Cable, Types W & G • Arc Welding Cables • Cord Sets • Asbestos Types • Plastic Jacketed Cords • Thermostat Wires • And Many Others

CAROL CABLE COMPANY

Division of the Crescent Company, Inc., Pawtucket, R.I.

For phone number of closest representative see advertising index in back of book.



ON IDAHO POWER COMPANY'S 34.5-KV LINE

. . . these 75-kva Pole Stars step down the high voltage to 240/480 volts. They supply power to a 200-hp deep-well pump that operates day and night to irrigate 320 acres of otherwise unarable land. The sustained performance of these transformers—which must operate in widely varying temperatures—is a matter of economic necessity to the utility customers involved.

You Get "Power Transformer Ruggedness" in High Voltage Pole Star Distribution Transformers

With wide experience in the design and construction of power transformers, Pennsylvania Transformer has the specialized knowledge and skill needed to satisfy the rigorous demands of high voltage transformer applications. The internal ruggedness that typifies Pennsylvania's power transformers also is designed into higher voltage Pole Star Distribution Transformers.

For example, the sturdy high voltage lead supports form an integral part of the coil . . . coils have extra bracing top and bottom to protect against possible short circuit forces . . . the core frame is of especially sturdy angle-and-channel construction . . . and tap changers feature power transformer ruggedness in both design and construction.

As a result, high voltage Pole Stars deliver economical, sustained performance in even the most demanding distribution transformer applications. The pictured 34,400-volt installation is a convincing example. For more details contact Pennsylvania Transformer Division, McGraw-Edison Company, P. O. Box 330, Canonsburg, Pa.

McGRAW EDISON

PENNSYLVANIA TRANSFORMERS — POLE STAR

PENNSYLVANIA DISTRIBUTION TRANSFORMERS

For phone number of closest representative see advertising index in back of book.

our convention-goer can hop over to Paris for the biennial meeting of CIGRE, at which electrical engineers from all over the world will gather on June 15 to hear 130 technical papers on electric power generation and transmission problems throughout the world.

Ocean hopping is becoming so commonplace and international visits so frequent that the Edison Electric Institute has created a Committee on International Cooperation to maintain general contact with our State Department and with foreign groups who visit the United States on power supply matters.

PROFESSIONALISM—The National Society of Professional Engineers has restated its stand concerning the relationship between unionism and professional responsibility. And we quote:

"Collective bargaining for professional engineers is in conflict with the basic principles of a professional individual.

"The individual responsibility and independent judgment required of a professional engineer are incompatible with the regimentation fundamentally inherent in unionization.

"Collective bargaining divides the members of the profession into hostile groups and promotes discord among members of the same profession.

"Constructive relations between professional engineers and management, and the full development of professional engineers can best be accomplished through programs in cooperation with all elements of the engineering profession.

"More than 20 years of experience and experimentation demonstrate conclusively that the individual engineer and the engineering profession are best served through reliance upon the professional concept of solidarity in service to the public welfare and avoidance of collective bargaining."

PARTY LINE—Western Union will construct a 3,700-mile microwave link between Boston and Los Angeles, utilizing General Electric's new 600-channel transistorized voice carrier-multiplex system. When completed in late 1961, the network's capacity will be more than a million words a minute in each direction from coast to coast and will have a capacity of more than 50 million miles of telegraph channels for Western Union's expanding private wire and data processing systems, facsimile and other services.

ROYAL ELECTRIC

FIRST CHOICE

among men who know portable cord!

Yes, more electrical contractors and maintenance men specify Royal than any other portable cord in its class! Why? The reason is simple, but important to men with jobs that depend on the quality, safety and durability of the flexible cord they use: every foot of ROYAL cord and cable meets the high-performance standards you need on the job.

Your wholesaler stocks a complete range of Royal types and sizes — rubber, neoprene and plastic jacketed cords, power cables, thermostat cable, lamp and fixture wires, machine tool wires, and heavy-duty "POWR-KORD" extensions. All *made* right, *priced* right, *packaged* right — quick and easy to use!

Next time you order cords, specify ROYAL . . . preferred by electrical men everywhere!

ROYAL ELECTRIC . . . an associate of LTT

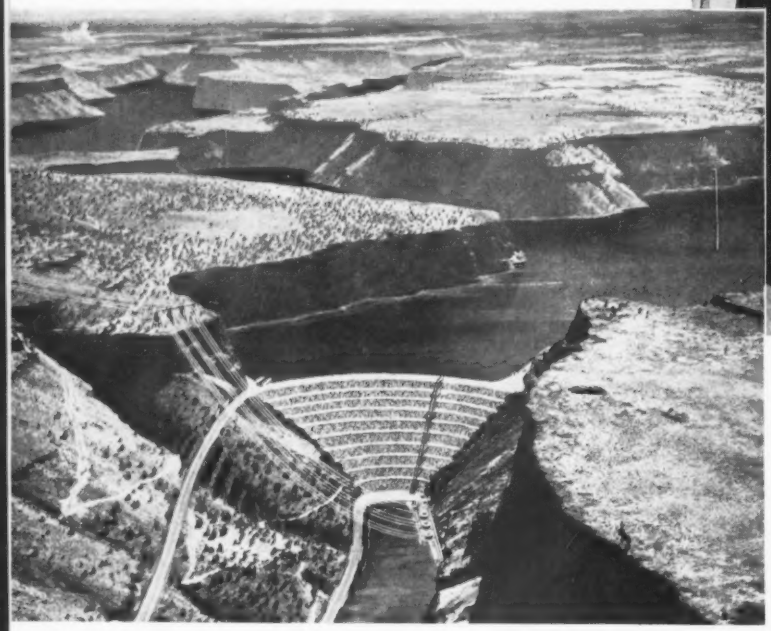
ROYAL ELECTRIC CORPORATION
PAWTUCKET, RHODE ISLAND
In Canada:
Royal Electric Company (Quebec) Ltd.
Pointe-Claire, Quebec

SALES REPRESENTATIVES AND WAREHOUSES: Los Angeles—1950 Naomi Avenue, RI 7-9655; **San Francisco**—1225 Sixth St., HE 1-5792; **Seattle**—4130 First Ave., So., MA 3-8882; **Denver**—888 S. Lipan Street, WE 6-3456

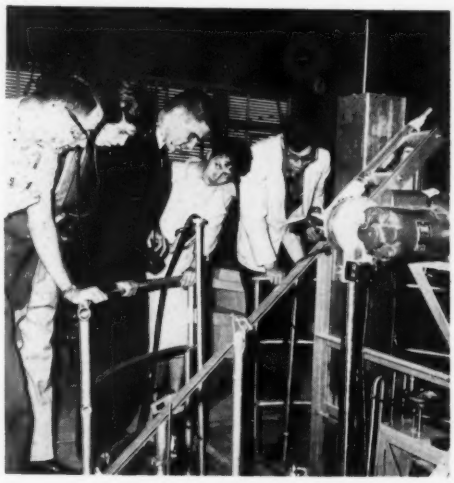
news

Some 1,500 attended Westinghouse Electric Corp.'s 74th annual stockholders meeting, held in the California Masonic Memorial Temple at San Francisco on April 6. President Mark Cresap told the group that the company's California stockholders had increased some 40% since the first West Coast meeting in 1954 at Sunnyvale. (See Manufacturers, p 91)

A group of Westerners look over the NEMA exhibit at EEI's Annual Sales Conference, held in Chicago, April 4 to 6. B. P. Montagriff, RMEL director, at left, talks with William Huntsman, John Dalsant and Glen Hagemeier of PS of Colorado

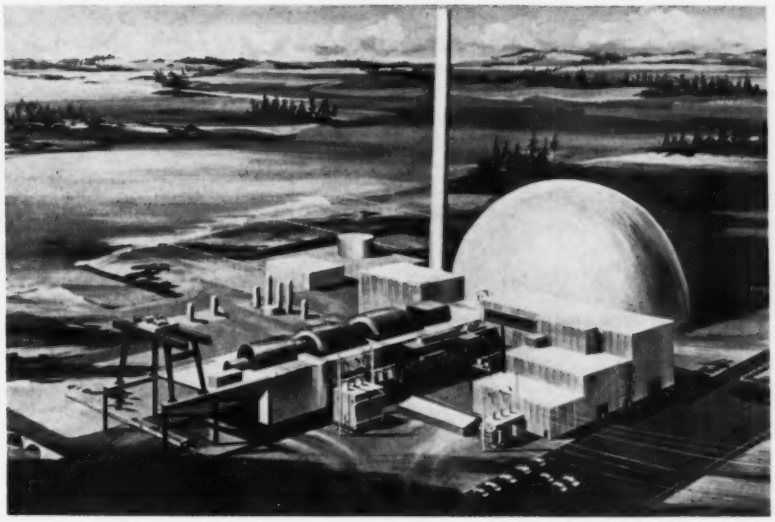


Artist's drawing of Portland General Electric's proposed Round Butte Dam on the Deschutes is imposed on an aerial photo of central Oregon's high plateau country to show how the structure would form a three-pronged reservoir in three river canyons. At upper left is Crooked River, upper center Deschutes and at right Metolius



Triga nuclear reactor was one of the highlights of study trip taken by four Arizona high school students to General Atomic's laboratory near San Diego under auspices of Arizona Public Service. GA technician, left, explains principle of the reactor. The trip was one in a series of Youth Science Tours sponsored by the utility

EW



Southern California Edison plans to build nation's largest (360,000 kw) atomic power station. Here is artist's concept of the completed plant, which is to be built by Westinghouse Electric and Bechtel corporations. The 300-ton reactor vessel, utilizing the pressurized-water cycle, will be housed in the huge dome at the right

Southern California Edison to Build Nation's Largest Nuclear Power Plant

A letter of intent to negotiate contracts for design and construction of a 360,000-kw atomic station, sent by the management of Southern California Edison Co. to the Westinghouse Electric and Bechtel corporations, late last month, will focus national attention on southern California as the capital of nuclear power developments.

The plant will employ the world's largest atomic power reactor and will be the first to utilize modern steam temperatures and pressures on such a scale. It will utilize the pressurized water, closed cycle principle with water at a 2,000-psi pressure and will cost an estimated $70 million. The plant will be designed and built by Westinghouse with Bechtel as the engineering constructor.

Construction is scheduled to begin in 1961, subject to consummation of such matters as AEC approval, the selection of a site and completion of final contracts and design details. The plant is expected to be economically competitive with conventional plants over its lifetime.

PUD Will Try Again

The Thurston County PUD will use a rate increase by Puget Sound Power & Light Co. in another attempt to acquire company properties in its area, PUD Chairman Frank T. Meyer said April 6.

It tried once before, last fall when the rate increase was first proposed, but failed when courts ruled the PUD used faulty procedure in attempting to institute a special tax levy to finance a $100,000 study of the proposed acquisition.

"Since a rate increase was granted to the company, we will go ahead with our special levy," Meyer said. The new attempt for the 1.97-mill levy will be made at the PUD's budget meeting in August, Meyer said. The levy would be collected in 1961.

Meyer refused to consider putting the proposed acquisition to an advisory vote of the taxpayers, pointing out "there is no provision in the law for us to call an advisory election."

Hearing Date Set on Snake River Projects

FPC hearings will start July 18 in Washington, D. C., on conflicting applications by Pacific Northwest Power Co. and Washington Public Power System for developments on the Snake River.

Meanwhile, Clark County PUD commissioners have authorized a $45,000 loan to the Washington Public Power System to defray preliminary expenses connected with the proposed Nez Perce project.

Commenting on the loan agreement, Vincent M. Cleaveland, PUD manager, said he hoped filing by the public power group on Nez Perce will precipitate a decision in the senate on SCR 35, which would declare a moratorium on power projects in the middle reaches of the Snake River until adequate fish research has been accomplished.

In Astoria, Ore., the filing brought notice from the commercial fishing industry that it will increase its efforts to block a license for either Nez Perce or Pacific Northwest Power Co.'s High Mountain Sheep project.

PNP Action Criticized

Kinsey M. Robinson, chairman of the board of the Pacific Northwest Power Co., in Spokane, Wash., termed "unfortunate" the action of Washington Public Power Supply System in asking permission to build Nez Perce Dam on the Snake River.

Robinson said the Nez Perce site, below the mouth of the Salmon River, involves an "inferior project" and "serious fish problems." He also declared the action could "flame up a controversy that can only harm the Northwest's resource development program and the region's economic progress."

► **Tillamook PUD** in Oregon has filed for a preliminary permit for a hydro development on the Trask River.

New Studies Up Dam Potential

Officials of the Walla Walla District of the Corps of Engineers have said that John Day Dam eventually will become the greatest power producer on the Columbia River.

According to Col. Paul Symbol, district engineer, the dam eventually will have a plant overload capacity of 3,105,000 kw, which would exceed the output of Grand Coulee.

John Day is now in the initial construction phase. Power potential figures were brought out by new studies based on the latest developments by American manufacturers of large power units.

Colonel Symbol said the name plate rated generator capacity of each power unit at John Day will now be 135,000 kw, about 26,300 kw per unit greater than tentatively planned about two years ago.

PUC Decision on Rate Making

The California Public Utilities Commission has issued its decision in the investigation of proper rate making treatment of accelerated amortization and accelerated depreciation. In an eight-page decision and order, the commission said:

1. That for purposes of rate fixing utilities may charge to operating expense only the amount of taxes actually paid.

2. That it would leave to management of utilities the election whether or not to take accelerated depreciation on property acquired after Dec. 31, 1953.

3. That it would consider accelerated amortization on certified property in individual proceedings, since amortization is different than liberalized depreciation in that it provides a definite end to accelerated amortization in five years. (One-fifth of properties certified as necessary in the interest of national defense may be charged as depreciation each year for five years.)

Accelerated depreciation, which the order called liberalized depreciation, is possible under Section 167 of the Internal Revenue Code of 1954.

The commission rejected the claim of some utilities that liberalized depreciation results in a tax deferral.

The decision denied the plea of many utilities to be permitted to "normalize" tax payments, that is, to pay the lower tax resulting from taking liberalized depreciation but, for rate making calculation, to charge as an expense the taxes that would have been paid if straight-line depreciation were used.

The commission also rejected the plea of some parties to the proceeding that utilities should be ordered to take liberalized depreciation and pass on the amount of reduced tax payments to customers in the form of reduced rates.

The commission declared that rate fixing "is a practical and pragmatic procedure" and that "we cannot close our eyes to the future and what reasonably the future will produce." It said: "The record is clear that public utilities, for the foreseeable future, will continue to construct new plant to an extent which will be sufficient to more than overcome retirements to such plant. In such circumstances, the theory of normalization, based upon the concept of a deferred tax liability, would not have an opportunity to operate. Here, regulatory authority must be concerned with what reasonably will happen and not with that which theoretically might happen."

The commission pointed out that court decisions have rejected the theory of normalization and said it must be remembered that a public utility is not in the same category, factually or legally, as an unregulated company. It added that "in essence, a public utility is charged with the administering of a public trust delegated to it by the state."

New Organization

B. C. Engineering Co. Ltd. and Balfour, Beatty & Co. Ltd. of London have reached "agreement in principle" for the formation of International Power & Engineering Consultants Ltd., it was announced recently by B. C. Power Corp. Ltd., parent of BCE. The organization is an outgrowth of BB and B. C. Power Consultants Ltd., which was formed in 1958 to carry out the detailed engineering work on the Peace River hydroelectric project for Peace River Power Development Co.

Sir Andrew MacTaggart, chairman of Balfour, Beatty, Powers Securities Ltd.; Peace River Power Development Co. Ltd., will be chairman of the new firm. Deputy chairman will be A. E. Grauer, president of B. C. Power and B. C. Electric. Tom Ingledow, a vice-president of B. C. Power and president of B. C. Engineering, has been named president.

Discuss USBR Policies On Central Valley Power

USBR policies in the sale and distribution of Central Valley power were aired at a two-day hearing in Sacramento by the house special subcommittee on assigned power and land problems. Congressman John E. Moss (D) of Sacramento was chairman.

Floyd E. Dominy, reclamation commissioner, denied accusations by Congressmen Moss and Harold T. Johnson (D) of Roseville that the bureau is violating the public preference clause in reclamation law.

"Maybe our judgment has been open to question," Dominy said, "but I do not believe our marketing of power has been a violation of the law."

At issue was a block of power, 40,000 to 60,000 kw, which public agencies in northern California felt should be sold to them.

The bureau's position is that the full firm power output of the project is committed to preference agencies already, although Dominy and other bureau officials admitted the full 450,000 kw are not being used at the present time by the public preference customers. Dominy's explanation to the committee is that the government wanted to protect the future growth of the customers it now has.

Dominy told the committee the bureau is making a survey to determine whether it might be possible to add Redding, Calif., as a preference customer under a temporary contract, which would permit the bureau to withdraw service if it became necessary.

He emphasized, however, the bureau probably will insist on assurances that Redding has a stand-by source — either through a contract with the Pacific Gas and Electric Co., now serving Redding, or by its own power production system.

Congressman Moss attacked this as an unwarranted "paternalistic attitude" by the bureau. Dominy replied he did not want the government to be responsible for a situation where such vital facilities as hospitals would be without electricity in the event the bureau had to "shut off the switch."

Dominy indicated to the committee it may be possible for the bureau to provide Roseville, Calif., with additional power from the CVP on a temporary basis also. But here, too, he said, the bureau may require a stand-by source. Roseville now has a contract for 7,200 kw of CVP power. It expires next Dec. 31.

Set Price on Tillamook Properties

Tillamook County PUD and Pacific Power & Light Co. have agreed on a price of $3,915,000 for PP&L's distribution system in Tillamook County where the two utilities have duplicate services.

The PUD will seek a special election in August or September to ask voter authority for issuance of revenue bonds to make the purchase.

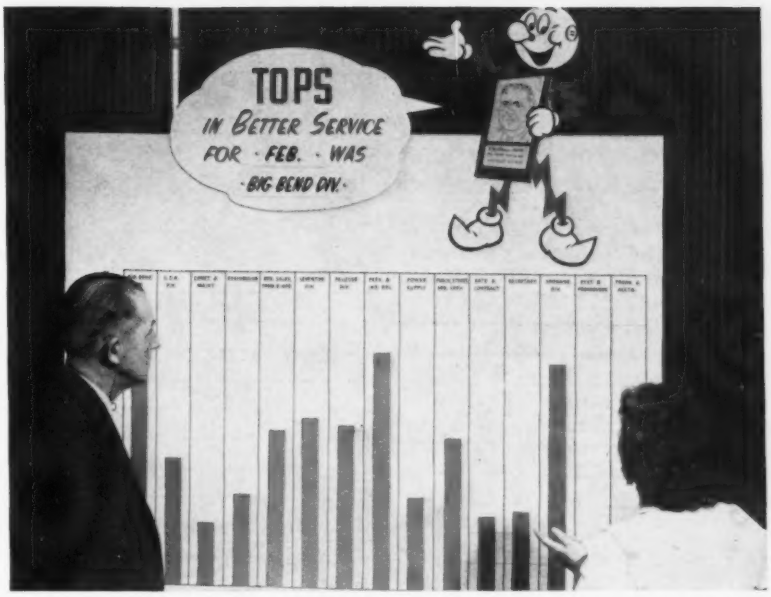
The price for the PP&L facilities was based on an engineering study and appraisal made by Cornell, Howland, Hayes & Merryfield, Corvallis, Ore., consulting engineering firm.

In an exchange of letters between the PUD and PP&L, the private utility expressed hope that if the voters did not approve the PUD bond issue that Pacific Power will be given the opportunity of deciding whether it should purchase the PUD properties.

► **The Association for Applied Solar Energy,** formed in Phoenix about six years ago, is now affiliated with Arizona State University in Tempe. In an administrative reorganization Brig. Gen. Harold Walmsley, U. S. Army retired, has been named president. Vice-presidents are Walter Lucking, president of Arizona Public Service Co., Henry Sargent, president of American & Foreign Power, one of the association founders and Jan Oostermeyer, who had been serving as president on a voluntary basis.

► **A Denver district court jury** awarded $175,681 to the widow of a lineman killed when a 36-ft pole broke while he was replacing a transformer. Highest ever granted in Colorado for a wrongful death, the damages were assessed against Broderick Wood Products Co. and Commercial Testing Laboratories of Denver. The jury agreed with arguments that Glenn Piper, lineman for Northwest Rural Power District, was killed because the pole, in place six years, had been improperly treated with preservatives.

► A study on Oahu's employment, population and housing has been issued jointly by Hawaiian Electric Co. and the Bank of Hawaii. Initiated by HECO as part of its program, "Planning Today for Tomorrow's Needs," the 107-page report predicts a population of 730,000 by 1970 and an employment increase from 1958's 198,506 to 262,090. Number of homes will be nearly doubled to an estimated 214,000 by 1970, the report states. In releasing it, HECO's President Ralph Johnson called for orderly growth that will enable Hawaii to keep its special culture. The same idea is expressed in a new series of company ads devoted to the background and institutions of the island's culture, and pointing to the blend of influences that make up that culture.



BETTER SERVICE—Washington Water Power is continuing its program to tell the public about its service through company employees on a person to person basis. This year departments and divisions are competing for the K. M. Robinson award. This trophy is sent each month to the one having the best record. Improvement will be surveyed at the end of the year and the department or division making the best showing will retain the award. Reddy Kilowatt shows off the award in this photo

Penalties Claimed

The Seattle Municipal Board of Public Works has notified Merritt-Chapman & Scott, contractor for the Gorge high dam on the Skagit River, that it is liable to penalties of $4,000 daily until it brings the dam to its full height.

A time extension on the project expired March 2 and the contract was scheduled for final completion April 6. However, with about two-thirds of the concrete for the structure placed, completion was thought unlikely before fall.

► **Pacific Gas and Electric** Co.'s property tax bill was the largest ever paid in northern and central California—$65,619,656. Total taxes for the calendar year of 1959 again set a company record, totaling $146,396,000, about 25¢ of every dollar received.

BCE-Grant Gives Electrical Engineering Chair

Establishment of a chair of electrical engineering at the University of British Columbia through a grant of $15,000 a year by B. C. Electric was announced recently. Dr. Norman A. MacKenzie, UBC president, said that the professor appointed should have enough free time from teaching duties to direct graduate studies and initiate and engage in an active research program in electrical engineering. The grant will be reviewed after the first three years.

► **Sacramento Municipal Utility District** will apply for an FPC license to construct the lower section of its Upper American River project at an estimated cost of $50,000,000. Included are: Slab Creek Dam, Chili Bar Dam and power plant and a 150,000-kw plant on the South Fork of the river north of Placerville. According to Paul E. Shaad, general manager and chief engineer, engineering studies show that with proper system integration the American River project will be able to produce nearly double the power capacity thought feasible 10 years ago.

► **FPC has set Sept. 8 for oral argument** in conflicting license applications of Pend Oreille PUD and city of Seattle for hydro developments on the Pend Oreille River. Seattle proposes a 540,000-kw Boundary project; the PUD, Z Canyon project, with 492,000 to 512,000 kw.

► Portland General Electric's Station B, **one of the nation's oldest existing hydro plants,** will be brought to the attention of visitors to West Linn, Ore. A large sign will tell the history of the plant, built in 1895. The idea was suggested by W. B. Corley, journeyman wireman, after he noticed large numbers of visitors to the adjoining Crown Zellerbach paper mill passing the old plant without a glance. Station B was built by and now carries the name of T. W. Sullivan, PGE hydraulic engineer from 1890 until his death in 1940.

► A 2,000-kw generator, which **Seattle City Light** had operated for 39 years with a single breakdown, went off the line March 9 when windings in the armature failed. City Light plans to rewind the unit, however, and put it back into service in about two months. The Westinghouse generator originally was installed in 1921 to supply temporary power for the construction of the Gorge power plant at Newhalem. Its single breakdown came in 1936. In 1949 it was made an unattended station and since had required only daily inspection and routine maintenance. "Older, less responsive controls" are blamed for the armature failure.

► A majority of the 1,700 employees of **Portland General Electric** Co. will get a 4.3% pay increase following signature of a one-year contract by PGE and local 125, IBEW. The increase, retroactive to March 1, raises wages for journeyman lineman to $3.37 an hour. The same percentage increase will be extended automatically to PGE employes not represented by a union. The IBEW represents more than half of the firm's employees.

► **Frank Bell** of Grant County PUD, who was convicted on five counts of first degree perjury before a county grand jury investigating construction of the PUD's Priest Rapids Dam, has sought a new trial or arrested judgment. The motion is based on "grounds of insufficient evidence and on numerous objections raised by Bell's attorneys over the admission of certain evidence during the trial."

Market Development

C. Worth Pollard of California Electric Works, chairman of San Diego Bureau's Kitchen Division, gives the first window decal to John Neenan, Kustom Kitchens, who originated the Certification program. Gordon Hillhouse of Howard Palmer, Kitchen Division vice-chairman, looks on. The program was inaugurated at a recent luncheon meeting

Qualifying Kitchens to Get Seal of Approval

An enthusiastic and sales minded group—The Kitchen Division of San Diego's Bureau of Home Appliances—has come up with another promotional idea to make Mr. and Mrs. America more kitchen conscious.

It is the Kitchen Seal of Approval program, launched recently at a luncheon meeting in San Diego. Under this program, believed to be a "first" of its kind in the U. S., new or remodeled kitchens that qualify will be awarded a Seal of Approval.

Hardin
Coordinator

Requirements are stiff enough to make the seal mean something. The kitchens must meet established standards of excellence in: (1) kitchen design with quality appliances; (2) adequate cabinet storage; (3) adequate wiring for full horsepower; (4) light for living.

Qualifications are clearly set forth in mimeographed sheets. Included are recommended circuit specifications for kitchen-laundry areas and minimum lighting and wiring requirements.

To qualify, the kitchen dealer submits a copy or blueprint of the proposed new or remodeled kitchen to the Kitchen Seal of Approval Committee. If the design is approved, the certificate and a gum sticker are given to the dealer, who makes the award to the homemaker.

Bill Finley, St. Charles Kitchen Designer, chairman of the Kitchen Seal of Approval Committee, awards the first certificate to Mrs. Peterson of La Jolla

An advertising program supporting the program includes newspapers, radio and TV. The idea was pushed also at the bureau's Spring Fair of Modern Home Ideas, held April 22-27.

According to J. M. Hardin of San Diego Gas & Electric Co., Kitchen

Division coordinator, the certification plan already is getting good response from dealers and the public.

Norge Tells Dealers "Person to Person"

In a Person to Person closed circuit presentation, Norge showed its 1960 line to dealers in 78 cities. Appearing in the 1½-hour program were Borg-Warner and Norge officials, who showed the line and told advertising plans.

Norge Board Chairman Jud Sayre closed with the announcement of a new stock plan running April through June 1960. For this period, dealers will be able to acquire common stock in Borg-Warner with purchases of Norge products above assigned quota.

At San Francisco, where W. J. Lancaster Co. was host, the TV program was preceded by luncheon at the Fairmount Hotel's Tonga Room.

► **U. S. Steel** is offering a free 16-page booklet, *What's What in Home Modernization*, in connection with its second annual home modernization program.

► **Arizona Public Service** Co. has put Reddy Kilowatt to work in retail appliance stores. Under a **Reddy Kilowatt recommended dealer plan,** franchised dealers who meet certain requirements receive 12-in. full-color window decals featuring Reddy and bearing utility recommendation for the store. The company's commercial offices are maintaining directories of names and locations of all recommended dealers and makes of appliances sold.

► **Sacramento Municipal Utility** District included a "business is good" theme with its 1960 sales promotion brochure, permitting it to be used as an area development device. Almost 300 of the folders were sent out with individually typed and signed letters to industrial prospects, factory locating services, consulting engineers and others throughout the nation.

► *Why Women Choose Electric Cooking* is the title of a pocket-size booklet prepared by Hotpoint and available at dealer stores.

PP&L Wins on Outdoor Advertising

Second award in the 8th annual outdoor advertising contest was won by Pacific Power & Light Co.

The illuminated outdoor display is one of a series that is maintained at permanent highway locations by PP&L in its campaign to promote the industrial, agricultural and recreational resources of the areas served, as well as the value and consumer benefits of modern electric service. It pointed to year 'round recreational facilities in Tillamook County, suggested "enjoy electric living, too!"

The national contest is sponsored by the Outdoor Advertising Association of America Inc.

► Portland General Electric Co.'s second annual **air conditioning and heat pump show** was to be held April 28-30 in the company's Portland Service Center.

In the third year of G-E's southern California trainload retail promotion, more than 12,000 appliances and TV sets valued at some $3½ million were brought into Los Angeles. In the cab for this picture are G-E District Manager William B. Frogue, right, with Ben Kroll, advertising manager, left, and Fred Curle, manager of dealer sales. A Golden 60 Special streamliner took a preview of the merchandise to 200 southern California dealers before the public offering

Communications

► **NCUR publication** – "Guide to the Preparation of Individual Radio System Operating Practices Manual" –has been brought up to date and can be obtained at no cost from regional NCUR sponsoring organizations or from NCUR Professional Assistance Associates, 600 Munsey Bldg., Washington 4, D.C. FCC rules require each user to adopt some type of standard operating procedure and the booklet will save many headaches for those who are about to start operation of a new system. Old systems can stand a brushing up sometimes, too.

► **Radio Transmitter Identification Tags** henceforth can be made of "metal or other durable substance" and will be required to show only the call sign and licensee's name and address. In addition, sections 11.15 (a) and (b) have been amended with regard to placement of the tags or form 452-C. These changes are very welcome and the rulemaking officially closes out Dockett 12573, which has been pending since 1958. Details are published in the March 23, 1958, issue of the Federal Register and will also be sent to those who subscribe to Volume V of the FCC Rules and Regulations.

► **Supervisory and telemetering** manufacturers who supply equipment for the military or gas and oil pipeline companies should not be overlooked by electric utility engineers. To a degree, the requirements are different; however, the techniques are advanced and the manufacturers are showing interest in adopting their product to electric utility use. Several satisfactory installations have already been made, largely in the east, however.

► L. E. Kearney, member of the Association of American Railroads, has succeeded L. E. Ludekens of Southern California Edison as chairman of the Operational Fixed Microwave Council. Other newly elected officers are: W. A. Shipman, Columbia Gas System, vice-chairman; F. G. Crowder, Los Angeles Communications Bureau, secretary. The council is representative of noncommon carrier microwave users, such as electric utilities, pipeline companies, etc.

► **Frederick W. Ford** has succeeded John C. Doerfer as chairman of the FCC. Doerfer resigned as chairman –by request–for allegedly receiving too many favors from an influential radio station owner. Ford has expressed his approval of proposed legislation to eliminate notarization of applications for construction permits, licenses and other necessary nuisances. The FCC deserves credit for its constant efforts to simplify or eliminate the multitude of forms used to obtain radio licenses.

Financial Briefs

► **Utah Power & Light** Co. will ask shareholder approval of a plan to change its corporate by-laws providing for a series of preferred shares. In a declaration of intention to SEC, the company stated that the provision would be for two million shares of $25 par preferred. In its annual report, UP&L said that it had increased plant and investment from $112,610,717 to $253,655,144 in the last decade but that average unit cost of electrical energy produced had dropped 11%.

► **Idaho Power** Co. reports that it expects 1960 earnings of $2.55 to $2.60 a share from gross revenues of $37 million. According to President T. R. Roach net contractual arrangements for sale of power are expected to add between $1.50 and $1.70 a share to earnings as they go into effect between now and 1967.

► Net earnings per share on **Hawaiian Electric** Co. common stock increased 8.3% to $3.28, the company reports. Net income in 1959 totaled $3,836,829 as compared to $3,173,463 in 1958 and $1,887,854 a decade ago. Operating revenues were $27,300,000, up $1,800,000 from 1958. HECO's subsidiary, Honolulu Electrical Products Co., had a net income of $185,565, compared to $71,780 the previous year.

► **Sierra Pacific Power** Co. has FPC approval to issue 49,714 shares of common stock, par value $7.50 per share.

► The Wyoming PSC has given **Cheyenne Light, Fuel & Power** Co. authority to sell $1,650,000 in securities. The company plans to use $950,000 of the proceeds to enlarge its plant facilities. The balance will pay off $700,000 in short-term indebtedness to its parent company, Public Service Co. of Colorado. The newly authorized securities will be 30-year 5½% first mortgage bonds.

► **Black Hills Power & Light** Co., Rapid City, S. D., has asked Wyoming PSC approval to issue and sell $1,000,000 in first mortgage bonds to finance additions and improvements to its plant facilities. The 5½% interest, 30-year maturity bonds will be sold to Equitable Life Assurance Society at 98.2% of their face value.

► **California Public Utilities** Co., San Francisco, has asked Wyoming PSC approval to authorize sale of $40,000 in additional shares of common stock. Proceeds will be used to replace the firm's treasury funds used for plant improvements.

► **California Electric Power** Co. plans to sell $12 million of first mortgage bonds at competitive bidding. Most of the proceeds will be applied to repayment of bank loans, which are expected to amount to about $10 million at the time of financing. The remainder will be used for the utility's construction program.

► **Public Service Co. of Colorado** reported net profit for 1959 was $11,369,000, up 4% from 1958. Gross revenue was $102,310,000, up $10 million from 1958. The gross revenue in 1948 was $42.7 million. The company at the end of 1959 was serving 330,779 electric customers, an increase of 10,800 over 1958.

► **B. C. Power Corp.** and its subsidiaries, including B. C. Electric, reported increased revenues and profits in 1959 with a net income of $16,272,352, an increase from $13,877,943 in 1958.

► FPC has authorized **Puget Sound Power & Light** Co. to issue $20 million of first mortgage bonds, due 1990.

► The Wyoming PSC has authorized **California-Pacific Utilities** Co. to issue 40,000 shares of common stock and to sell it to underwriters for $18.90 to $20.40 a share. The company plans to reimburse its treasury for money expended on past expansion programs.

Growth

BC's Bridge River Plant Near Completion

B. C. Electric's electric generating capacity rose to more than a million kilowatts with completion of the third 62,000-kw generating unit at the Bridge No. 2 hydroelectric project. B. C. Engineering Co. Ltd., project manager, reports that work on the development, some 130 miles north of Vancouver, B. C., is over 85% complete.

The fourth generating unit is scheduled to be brought on line in May, bringing plant capacity to more than 248,000 kw. At that time, the Bridge River area will have a total generating capacity of more than 512,000 kw.

► **Pacific Power & Light** Co. has announced a half-million-dollar expansion program in Converse County for the next two years. The program will extend rural lines to an area north of Douglas to serve farmers and ranchers. The 1960 construction program, estimated to cost $280,000, will consist of 109 miles of transmission lines to serve 20 townships. The 1961 construction program will extend the service to an additional 13 townships.

► Southern California Edison Co. broke ground in March for its $4,800,000 Long Beach office building. Designed by Architect Kenneth S. Wing, the 10-story building will be contemporary in style, with landscaped entrance court, reflecting pool and fountain. An advanced design all-transistor computing system will be installed on the ground floor in view of passersby. Edison will use three floors and the rest of the building will be leased to other tenants, by Associated Southern Investment Co. Myers Bros. Construction Co. has the contract.

City Light to Improve Distribution System

Seattle City Light has announced a six-year program to improve the appearance of its distribution system at an estimated cost of $7,680,000, to be met from revenues. The program calls for placing facilities underground and improving the appearance of overhead facilities.

As one of the projects, distribution facilities will be placed underground on the site of the Century 21 Exposition at a cost of $537,000. The plan also calls for eliminating overhead crossings of a new freeway and for converting additional overhead facilities to underground.

City Light is allocating $15,000 annually to set up an office of a coordinator to promote undergrounding of facilities by local effort and another $25,000 annually for preliminary engineering work to further these local improvements.

Cleanup of the overhead system will require some $500,000 annually.

Science

Peak at the Future

Recently researchers at the Westinghouse Research Laboratory took a group of industry executives behind the scenes for a glimpse of possible new methods of generating electric power. Working laboratory models of the fuel cell, the thermal-electric generator, the thermionic generator and the magnetohydrodynamic generator were displayed and discussed with particular reference to their possibilities for central station service.

The fuel cell (Fig. 1) is an electrochemical device that converts the "free energy" of a chemical reaction directly into electrical energy. It consists of an electrolyte sandwiched between two electrodes. The electrolyte transmits ions but not electrons. A low-cost fuel and an oxidant are fed continuously into the system with the oxygen molecule picking up electrons at the cathode and releasing them at the anode, thus creating a voltage differential. If low-cost natural fuels are to be used, then the cell must operate in the 1,800 F range. This is one reason why the cell will not immediately replace the turbogenerator.

Thermoelectric generators (Fig. 2) utilize the Seebeck principle, wherein the flow of heat through a metal segment produces a voltage difference between its hot and cold ends. New thermoelectric materials have enabled the previous low-power output of the devices to be raised and soon there will be a generator rated at 5 kw using this principle. These generators operate at about 2,000 F and large-scale use awaits still better and more permanent materials. Its big advantage is its ability to operate free from pressure considerations.

The thermionic generator (Fig. 3) operates at about 3,500 F. Within the thermionic tube, a glowing wire emits electrons causing current to flow in an ionized gas. As a competitor of the conventional power station, it should be of little worry as a 100-mw thermionic plant would require a cathode of about 10,000 sq ft operating at 3,500 F in a vacuum.

Magnetohydrodynamic generation (Fig. 4) utilizes the principle of passing an ionized gas (5,000 F) through a magnetic field to produce power. For a 100-mw MHD station, a gas chamber 3 ft in cross section and 60 ft long held at a temperature of 5,000° with gas moving at about three times the speed of sound would be required. Westinghouse scientists say a real breakthrough in materials will be required to make such a station practical.

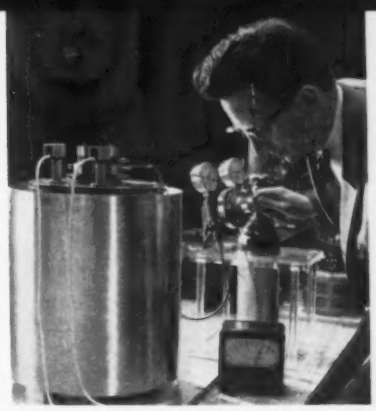


Fig. 1—Fuel cell generator

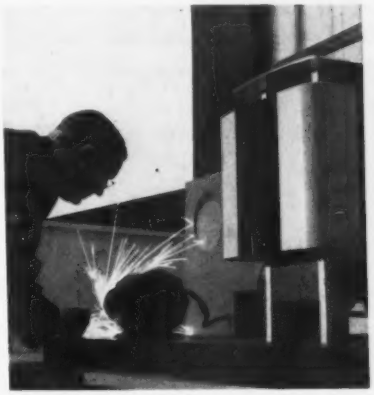
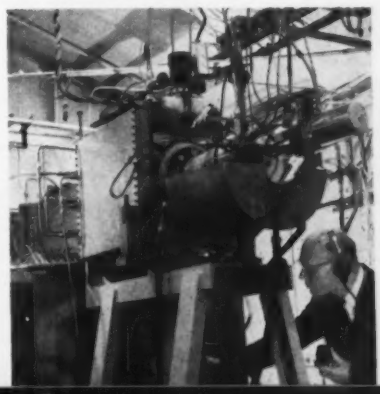


Fig. 2—Thermoelectric generator

Fig. 3—Thermionic tube

Fig. 4—Magnetohydrodynamic generator (10-kw rating)



Nuclear News

Power From Hanford Reactor

A report entitled "New Production Reactor Power Plant Economic Feasibility Study" has been completed by the FPC for the AEC. The unclassified portion of this report on the advisability of producing electric power from the new Hanford production reactor indicates that, on the basis of present day nuclear fuel costs, none of the 24 designs investigated were economically feasible.

These results were indicated despite the favorable cost allocation assumptions that were used. During the eight-year period of dual purpose operation (plutonium and electric power production) only the costs of building and operating the new electric production facilities were included. No nuclear fuel or reactor operating expense was charged to the electric production during this period. None of the capital cost of the reactor or its built-in convertibility feature was charged against power generation either in the dual-purpose period or the following power-production-only period.

Boiling Water Reactor News

The experimental boiling water reactor at Argonne Laboratory, which has been undergoing extensive modifications, has gone critical again. This reactor was originally designed with a rating of 20 thermal mw and had previously reached a level of 62 mw. These changes should allow attainment of a level of 100 mw, five times the original design.

The Dresden nuclear plant of Commonwealth Edison Co. has been reloaded with 448 fuel elements. Power tests are being conducted up

*Trademark

Fine Fanner Superformed Products

"Superforms* help me keep lines in service"
...DISTRIBUTION ENGINEER

"To me, the word 'Superformed' means a number of plus values:

"*Service continuity* to keep our customers satisfied . . . *low maintenance costs* . . . in short, *greater dependability* and *savings*."

Everywhere, Distribution Engineers . . . *the men technically responsible for keeping customer lines in service* . . . acclaim Fanner Superforms.

A-1586A

FANNER
Superformed*
with a
"PROTECTIVE TWIST"

ARMOR RODS . . .
Protect long-span T&D lines at supports

LINEGUARDS . . .
Protect short-span T&D lines at supports

PATCH RODS . . .
Repair damaged conductors

TAP ARMOR . . .
Protects conductor at tapping points

FANNGRIPS . . .
For dead-ending strands and conductors

FANNSPLICES . . .
Join two ends of conductor wire

PLASTIC PRODUCTS . . .
For conductor surface protection

FANNER
The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

to one-half full load (315 thermal mw). The AEC has directed the holding of a public hearing on May 4 to consider the application by Commonwealth to raise the reactor to its full load operating level of 630 thermal mw (180 electrical mw). The project is substantially ahead of the contract schedule, which calls for General Electric to turn the plant over to Commonwealth on Dec. 8, 1960.

The Los Angeles Department of Water & Power has indicated that it is going after the 50 to 75 electrical mw improved cycle boiling water reactor on which the AEC has invited bids due May 4. This large municipal utility is ready to spend $10 million to match a like amount from the AEC for this project. General Electric Co., Allis-Chalmers Co. and Combustion Engineering Co. have all made proposals for building this reactor.

The hearing scheduled by the AEC on the Humboldt Bay plant of the Pacific Gas and Electric Co. for April 14, was postponed at the request of the company. The reason for the delay is to allow completion of further tests on certain plant components. On March 14 the advisory committee on reactor safeguards submitted a report on the safety aspects of this plant. This report stated that it has not been demonstrated that the vapor suppression system proposed can be relied upon to protect the health and safety of the public at this site.

1960 Nuclear Congress

W. Kenneth Davis, vice-president of Bechtel Corp., speaking at the sixth Nuclear Congress in New York, said that the future of the atomic energy industry depends to a large extent on the ingenuity and cost consciousness of engineers. This can only be attained, he explained, through experience involving the many engineering disciplines.

Westinghouse Electric Corp. executive J. W. Simpson predicted at this meeting that by 1970 the United States will be able to orbit a nuclear powered electric generating system with a capacity of 60,000 kw.

The results of a General Electric Co. study reviewed at this nuclear congress indicates that the large superheat reactors appear to offer sizable potential savings in nuclear fuel costs. The smaller fuel cycle costs, together with probable capital cost savings for large superheat units, points to an over-all reduction in the present cost of nuclear power of about 0.67 mills per kwh.

Domestic Uranium Reserves And Civilian Reactor Costs

The AEC during the past month released figures on uranium reserves and on civilian reactor costs. The first report indicated that domestic uranium reserves amenable to treatment as of Dec. 31, 1959, were 86,100,000 tons or 2.8 million tons less than its report for July 1, 1959. The average price paid for concentrates dropped from $8.99 per lb to $8.79 per lb during this period.

In a second report the commission announced that the estimated total cost of 46 civilian reactor projects actively under design or construction is $862 million of which about $358 million has been incurred as of Dec. 31, 1959. Expenditures during the last quarter of 1959 on these projects amounted to $60 million.

AEC Proposes New Regulations

The commission has announced a contemplated set of new rules for shipment of spent reactor fuels. These rules indicate specifications for spent fuel shipping casks that would weigh from 10 to 70 tons and cost up to $100,000 each. Among other things, these casks must have the structural integrity to withstand a 30-ft drop on to a solid concrete surface. Irradiated fuel elements must be allowed to undergo radioactive decay for a sufficient period prior to shipping to prevent the maximum fuel element temperature from exceeding a temperature 180 F below their melting point, while in the casks. Primary cooling outside the casks would be prohibited.

The commission has revised its indemnity regulations under which financial protection against a nuclear incident is given to the public. The minimum insurance or financial protection for any nuclear reactor has been raised from $250,000 to $1 million. For reactors with thermal power levels up to 10 mw, $1 million to $2.5 million protection would be required. For all reactors having thermal power levels above 10 mw, a formula based on thermal power level and population density would be used to compute the amount of protection, which would range from $3.5 million to $60 million. All reactors having a rated capacity of 100 electrical mw or more would require $60 million, the maximum amount of nuclear liability insurance available from the insurance industry.

NOTICE!

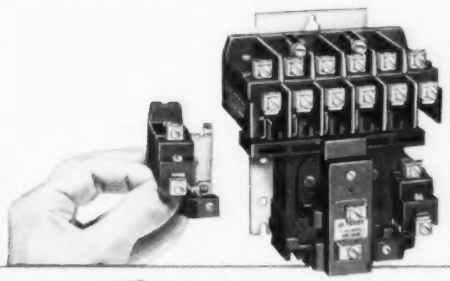
60 Second Contact Convertibility

ALLEN-BRADLEY CONTROL RELAYS

can thus easily be changed
from N.O. to N.C. (or vice versa)

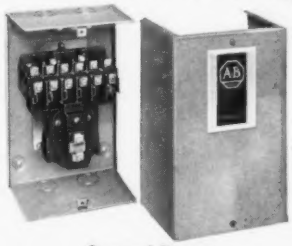
Why not give yourself a real surprise! We refer to the ease with which you can convert the contacts of these Allen-Bradley Bulletin 700 Type BR control relays. Using only a screwdriver, contacts can be changed from normally open to normally closed (or vice versa) in seconds—without removing the relay from its mounting—or its wiring. This "on-the-spot" convertibility certainly suggests an appreciable moneysaving reduction in your relay inventories.

Extensive tests have proven conclusively that the Bulletin 700 Type BR relays are good for many—and we mean *many*—millions of trouble free operations. A "built-in" permanent air gap completely eliminates all possibility of magnetic sticking. Naturally, the double break, silver contacts never need attention. Also, the molded coil is your assurance that even the most severe atmospheric conditions cannot cause trouble. Please write for full details on these relays today!



BUT HEAR THIS!

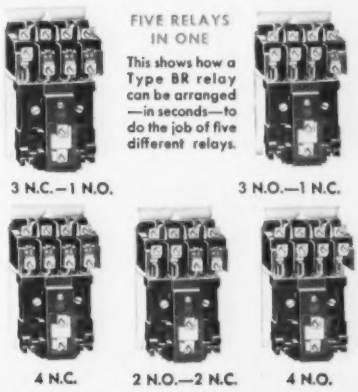
In the event that when "on-the-job" it is discovered that something was either overlooked or added, the standard Bulletin 700 Type BR—either 2, 4, or 6 pole relay—can easily have added to its base, out in the field, either one or two switching poles. It is done as easily as "falling off a log."



General-Purpose
NEMA 1

Explosion-proof
NEMA 7

Waterproof
NEMA 4


FIVE RELAYS IN ONE
This shows how a Type BR relay can be arranged —in seconds—to do the job of five different relays.
3 N.C.—1 N.O.
3 N.O.—1 N.C.
4 N.C.
2 N.O.—2 N.C.
4 N.O.

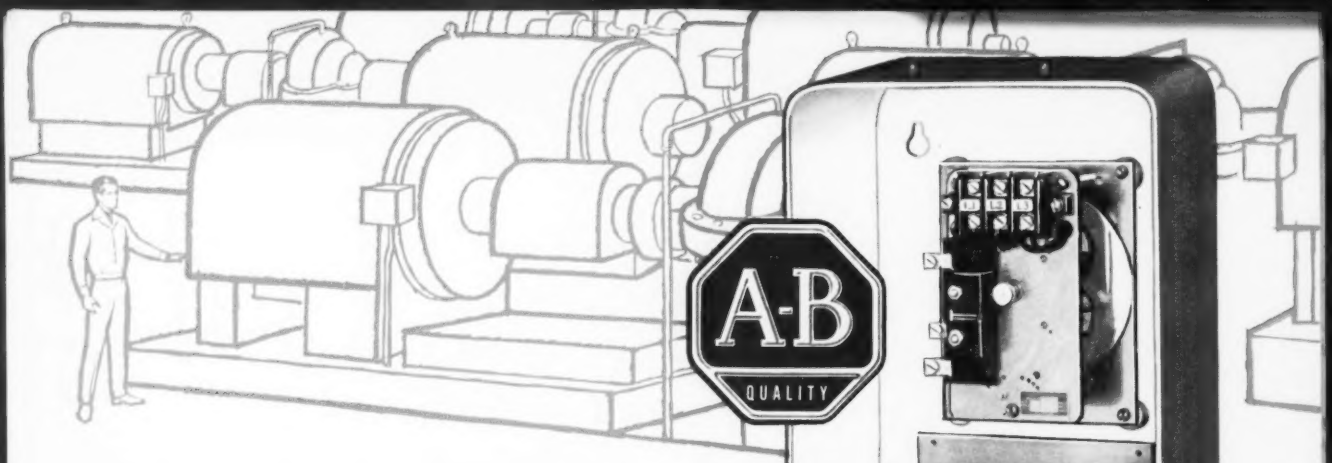
8-60-RM

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL



ALLEN-BRADLEY PHASE FAILURE and PHASE REVERSAL RELAYS

will provide positive protection for high-horsepower, high-priced motors!

It's sound "economy" to guard your investment in expensive motors and equipment against the extensive damage that can result from a phase failure or phase reversal. Allen-Bradley's Bulletin 812 Style RF relay provides *complete, positive* protection against both of these hazards.

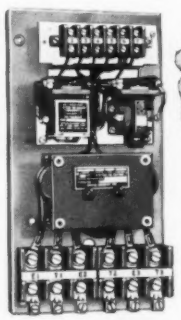
The Bulletin 812 Style F phase failure relay instantly detects *all* open phase conditions on a motor branch circuit and removes the motor from the line—yet is not subject to nuisance dropouts from transient line fluctuations. An unusual feature of this Style F relay is its positive response, regardless of motor load or type of motor branch circuit employed.

The Bulletin 812 Style R phase reversal relay disconnects the motor from the line—whether it is running or not—when a phase reversal occurs on the line side of the relay. Thus, it can be used to protect a single motor or a group of motors. Furthermore, the Style R relay removes the motor from the line should a phase failure occur while the motor is stopped.

All A-B Bulletin 812 relays are completely "fail safe." It will pay you to investigate this economical insurance against the heavy losses that can—and *frequently* do—result from phase failure and phase reversal. Write today!

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

Bulletin 812 Style RF for Phase Failure and Phase Reversal consists of Style F Phase Failure and Style R Phase Reversal relays in the same enclosure.



Bulletin 812 Style F for Phase Failure

Bulletin 812 Style R for Phase Reversal

B-60-RM

ALLEN-BRADLEY

Member of NEMA

Quality Motor Control

Charles Tabor, Knox Bourne, Charles Hays and the Electrical Industry Show—at right

EMEA INDUSTRY SHOW COMBINES CONFERENCE

Each time the Electrical Industry Show of the Electrical Maintenance Engineers Association of California grows bigger and better. The 10th biennial show proved it again. It not only packed the Shrine Exposition Hall in Los Angeles, March 23-26, with more and finer manufacturers' exhibits but combined with it its alternate year feature, a conference. And this conference was on the timely subject, *lighting*.

So the EMEA show this year was jumping on the main floor, visited by crowds of invited and selected people in more than 25 area industries in every management, supervisory, design or maintenance classification. Then in the basement, in five especially setup conference rooms with stages equipped as model displays of typical lighting equipment, large groups attended the lighting lectures by nationally recognized authorities. (See account on page 21.)

Attendance, too, exceeded all previous records for both exhibits and conferences, thanks to an intensive publicity campaign preceding the show. Admission was free to invited and qualified guests but the general public was not admitted. Hence it was a selected and vitally interested number of people influential in the selection and then operation of equipment that toured the 161 exhibits, estimated to have totaled some 20,000.

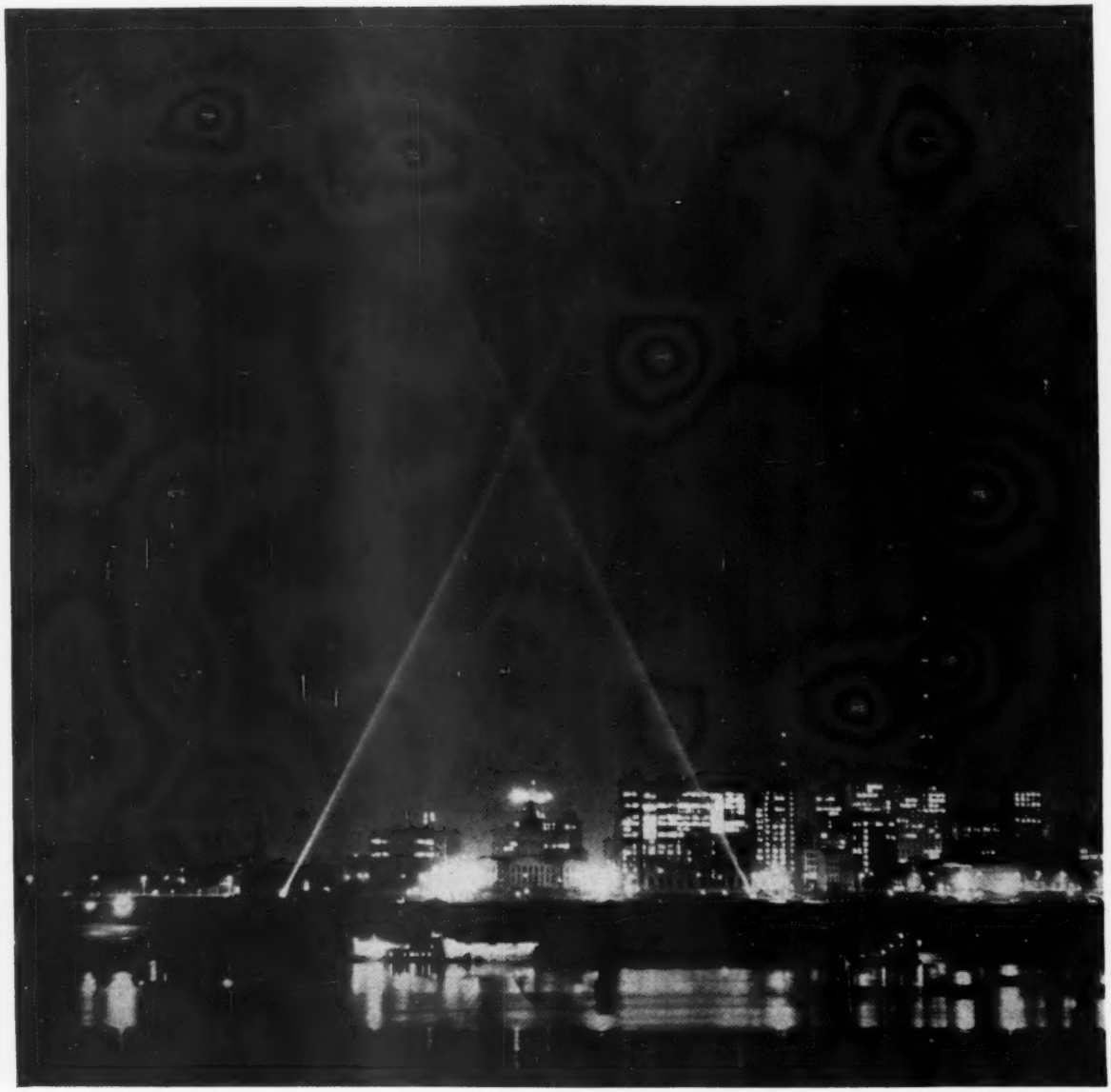
Experienced in the handling of previous shows as well as exceptional organizers, two past presidents of EMEA, Charles H. Hays of Electrical Estimators Inc. and Robert Marcum of Hughes Aircraft Co., were co-chairmen of the show and ran it with precision. The advisory board was headed by Charles M. Tabor, Larsen-Hogue Electric Co., EMEA president, and included vice-presidents Paul H. Henrichs, Southern California Edison Co., and Frank R. Tharp, Floodlight & Fluorescent Maintenance Co. Inc.; Lloyd A. Gates, Los Angeles Department of Water & Power, secretary; Urban Beh, consulting lighting engineer; Ernest A. Burgess, Horkey-Moore Associates; O. D. Land, Bay Cities Floodlight & Electric Co.; Frank S. Miller, Robertshaw-Fulton Controls; and William R. Paluska, A. C. Martin & Associates.

Great difficulty was experienced by the committee from the Purchasing Agents Assn. of Los Angeles to select the three outstanding manufacturers' exhibits for the ELECTRICAL WEST award of recognition. Superior Electric Co., with its mobile exhibit mounted on a large truck trailer that was moved into the end of the exhibit hall, was selected by the Purchasing Agents for first award. Second award was made to the General Electric Co. exhibit, and third to the Sylvania Electric Products display. Appropriately, all three were connected with lighting or the control of it.

So impressed were these judges with the exhibit of the Los Angeles Trade Technical College, built and manned by students, that they recommended a special honorable mention award to them, which ELECTRICAL WEST accorded.

Superior Electric's Ernest Crapser, Edward Burke, E. S. Williams and M. Hollingsworth receive first place award for outstanding exhibit from W. A. Cyr, consulting editor. Show Chairmen Robert

Marcum and Charles Hays witness extra honorable mention award by Electrical West to Los Angeles Trade-Technical College's Student John Mogensen and Instructor Walt Allrich



Meet me in St. Louis . . .

Foresight founded St. Louis, Missouri, as a French fur-trading post in 1764, and helped it grow to the nation's eighth largest city . . . to become a manufacturing center for 3,300 different products while remaining the nation's largest raw fur market.

Foresight on the part of local electric utilities and 18 trunk line railroads has supplied this city's commerce, homes and industry with power and transportation to keep St. Louis growing.

Foresight has enabled Kerite Cable to serve the past and present needs of power, railroad and other industries with a high standard of dependability—a standard maintained since 1854. *And when tomorrow's problems occur, Kerite will already be ahead of them.*

KERITE CABLE

it's the **KERITE** *that makes the difference*

General Office—30 Church Street, New York 7, N. Y.

SALES OFFICES:
Albuquerque, Ardmore, Pa., Birmingham, Boston, Chicago, Cleveland, Denver, Glendale, Cal., Houston, Lake Wales, Fla., Portland, Ore., St. Louis, Salt Lake City, San Francisco, Seattle

In front of special school stage set Charles Gibson tells factors wanted by the schools

NEXT MONTH

Spring conferences of PCEA's Engineering and Operating and Administrative Services Sections, held early in April, will be reported in full next month, along with late April and May meetings customarily covered in Electrical West's June Convention's Report.

LIGHTING CONFERENCES DRAW CROWDS

Successful in their own right were the lighting conferences, which ran with one exception during the mornings and afternoons while the show on the main floor ran afternoons and evenings. The caliber of the speakers and the breadth of subjects drew audiences of more than 100 to each session. There were sessions on industrial, school, office, store and outdoor lighting, each given twice, a total of 10 in all.

Five stages were set up in the lower floor area. Each represented a laboratory demonstration of one of the kinds of lighting programmed. The speakers were nationally known authorities on each subject, brought together by Urban Beh, lighting conference chairman, and his industry committees representing each type of lighting. They drew sincerely interested audiences that participated actively in discussion and in questions to the experts.

Industrial lighting was covered by Robert Clubley, General Electric Lamp Division, in a presentation, "Lighting in the Electronic Age." School lighting, under Chairman Bill F. Jones, Smoot-Holman Co., had Charles D. Gibson, director of school planning, State of California, and John M. Chorlton, Toronto Board of Education, whose subject was "Design for Seeing." Office lighting, under Chairman James D. Bond, Lighting Dynamics, had as speakers two officers of IES, Past President George J. Taylor, Day-Brite Lighting Inc., St. Louis, and J. S. Hamel, consulting engineer, an IES director. They spoke on "Modern Trends in Office Lighting" and on "Integration of Lighting and Air Conditioning," respectively.

Store lighting was covered by Jerry Silvers, Globe Illumination, chairman of the committee, in one evening and one morning session on "The Art of Lighting for Merchandising." Outdoor lighting had four topics covering as many aspects of that subject. James M. Dowtin, General Electric Co., spoke of "Street and Highway Lighting" and A. L. Pryor, consulting engineer, on "Parking Area Lighting." On a separate program William S. Shalda, Shalda Mfg. Co., spoke on and demonstrated "Architectural and Building Floodlighting" and Pryor repeated his talk on lighting of parking areas. Paul Ogilvie of Pacific Union Metal Co. was chairman of this group.

The conferences and show were kicked off by a luncheon catered at the auditorium on Wednesday noon, March 23. At this the speaker was Knox Bourne, vice-president, South Pacific District, McGraw-Hill Publishing Co. His talk outlined "Electricity's Share in the Golden Sixties."

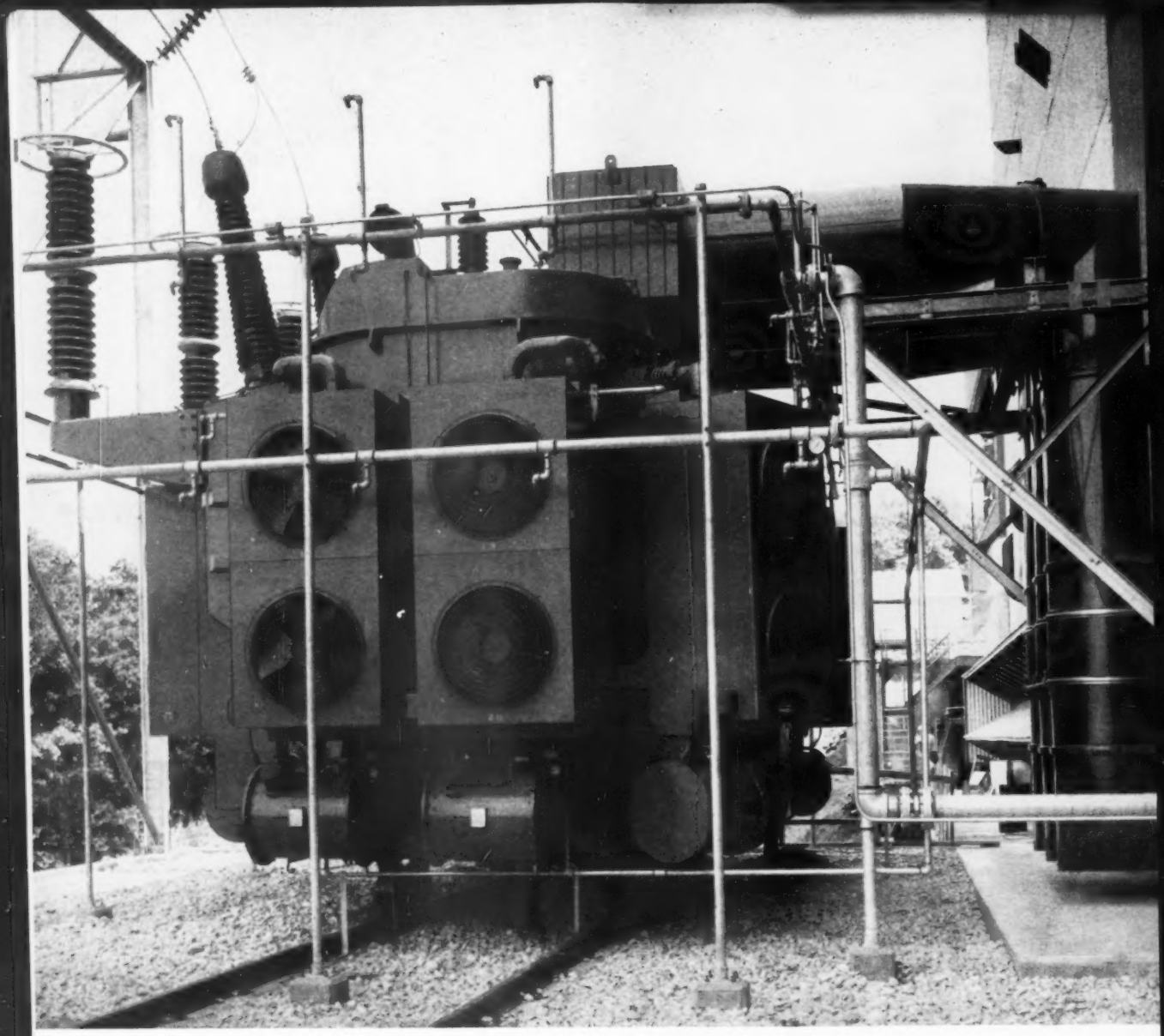
Urben Beh
Conference chairman

George Taylor
Day-Brite

Sam Hamel
Consulting engineer

Robert Clubley
G-E

A. L. Pryor
Consulting engineer



217,000 KVA, CLASS FOA, 230 KV

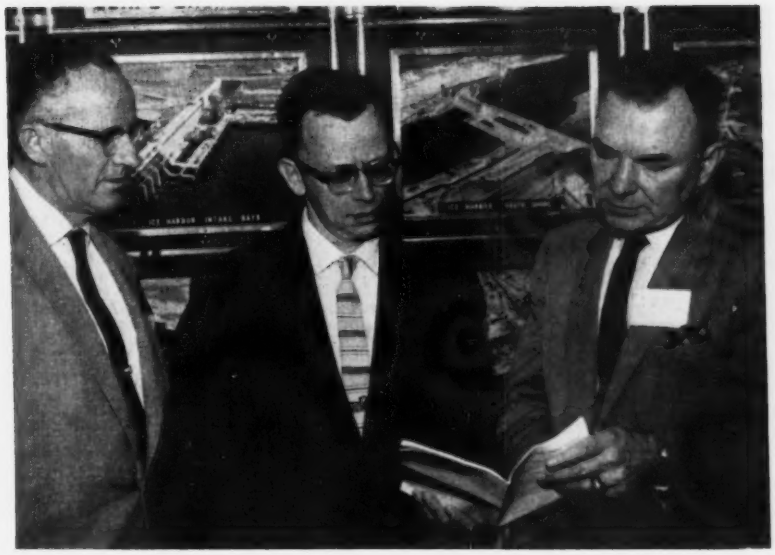
Another example of Moloney's ability to provide power transformers for every application is this 217,000 KVA, 230 KV Generating Station Transformer, built by Moloney. Now installed and in operation in a large eastern utility system. Specify Moloney... and get the *right* transformer to fit *your particular* needs.

217,000 KVA, 230 KV, 3 phase, Type FOA
HV 234,000 Grd.Y/135,000 volts
LV 13,500 volts delta
2—2½% no-load taps above and below normal

Since 1896... MORE POWER TO YOU

MOLONEY ELECTRIC CO., ST. LOUIS 20, MO., TORONTO, CANADA

MOLONEY ELECTRIC



Dean Barline (center), new president, with Dan Jolly, left, vice-president, and Gus Norwood, who is starting his 13th year as NWPPA executive secretary

NWPPA HOLDS ANNUAL MEETING AT EUGENE

The Nez Perce project, the California-Northwest intertie studies and power from the Hanford project were main topics at the annual meeting of the Northwest Public Power Assn. April 6-8 in Eugene, Ore.

Delegates adopted resolutions concerning all three. They commended the Washington Public Power Supply System for applying for an FPC license for the Nez Perce project, asked the Department of the Interior to delay action on the BPA-PG and E intertie proposal until the State of California's intertie study has been sent to Congress and urged federal authorization of power generation at the Hanford project.

The Nez Perce filing had the star role throughout the meeting. Discussion left no doubt that the push is on to get firm backing from municipals and co-ops outside of Washington, although unanswered legal and political questions apparently stand in the way of immediate outright action by these groups.

No application has yet been made by WPPSS to the Oregon Water Resources Board, which continues to maintain its right of domain over the Oregon side of the Snake River.

The resolution commending WPPSS endorsed "policy statements which assure that power will be offered under contract with first option to purchase to the consumer-owned electric systems in the Pacific Northwest, giving full consideration to equitable distribution of the power within the States of Oregon, Washington, Idaho and Montana. . ." The resolution embodied a recommendation that NWPPA members "express an interest in being afforded an opportunity to enter into contracts to participate in and share the benefits of the proposed development."

Despite assurances from Owen Hurd, managing director of WPPSS, that the fish problem at Nez Perce can be solved and that its flood control features will actually enhance fish production, the big salmon question was raised on the floor in legislative committee consideration of the resolution.

The Nez Perce discussions also made clear that competitive filings will be the new public power method of opposition to private power developments, like Pacific Northwest Power Co.'s High Mountain Sheep, which Nez Perce would eliminate.

Little new ground was covered in the discussion of interregional interties by a panel headed by Ken Billington, executive secretary of the Washington PUD Assn., and including Eric Johnson, manager of Wasco Electric Cooperative and Northern Wasco County (Ore.) PUD, and John Nelson, assistant superintendent of Seattle City Light.

Criticizing both the assumptions and the approach taken in the intertie study made by Bonneville Power Administration last year, Billington said these were reasons sufficient for the Senate Interior and Insular Affairs Committee to wait for completion of the study being made by H. Zinder & Associates for the State of California before it acts on the BPA report.

Dr. William A. Pearl, BPA administrator, later defended both the report and the offer from Pacific Gas and Electric Co. to buy surplus BPA power that prompted it. Of PG and E's offer to take BPA dump power over a 230-kv line it would build to the Oregon-California border from its Pit No. 3 plant, Pearl said: "It would save power going to waste. It would save oil in California. It would give up $1.8 million a year revenue and I don't mind telling you Bonneville is looking for revenue."

Review of history and status of the Hanford convertible reactor, which could provide from 654 to 756 mw of power for the Northwest power pool, was presented by Hurd.

The meeting by resolution favored federal authorization of generating

Mrs. Anna Dahl of Dagmar, Mont., and Paul Rohwer, Anchorage, Alaska, members of the board of trustees, talk with Brig. Gen. Allen F. Clark Jr., a conference speaker

With

SUPERIOR

SD CONTROL

CABLE...

QUALITY

comes in a small package!

For the maximum number of control circuits in the least amount of space... top quality SUPERIOR SD Control is the answer.

Overall diameters are reduced by as much as 20% to 35% *without* any sacrifice of reliability in performance!

High quality polyethylene, armored with tough nylon, insulates the flexible, stranded conductors. Color-coding to meet your requirements. Non-hygroscopic tape covers the core... and the smooth, neat jacket of durable polyvinyl chloride has excellent resistance to oils, alkalies and solvents. Conduits are not needed.

For performance and economy... for more circuits in less space... use high quality SUPERIOR SD Control Cable.

For complete information and prices, write

SUPERIOR CABLE

SUPERIOR CABLE CORPORATION

Hickory, North Carolina

4710

facilities at Hanford, provided timing of actual construction is governed by economic considerations as compared to alternative power sources.

A panel on electric service entrance policies explored the benefits of subsidizing installations of 200-amp entrance panels. Harley Bryant, commercial manager of Chelan PUD, said that in 1956, first year after the utility began reimbursing customers installing 200-amp panels, 96 homes were rewired, 48 of them for electric heat. In the 96 rewired residences, energy sales have increased 83% and revenue to the district 75%.

"Why shouldn't we as an industry furnish the entire service entrance and, if we wish, capitalize it? The telephone company has done well and it even owns the appliance," Bryant commented.

Seattle City Light's program of substation beautification and underground transmission was placed in the light of "good citizenship" by Dr. Paul J. Raver, superintendent of Seattle City Light and president of the American Public Power Assn., in the keynote talk of the meeting.

Other speakers included Dr. Garth Griffiths, director of administration for British Columbia Power Commission, who related the great changes that have come since 1956 in the thinking of the B. C. population about power development.

Brig. Gen. Allen F. Clark Jr., North Pacific Division engineer of the U.S. Army Corps of Engineers, reviewed status of the corps program and showed a new color movie — *The Columbia: River of Planned Destiny.*

Other resolutions urged:

Amendment of the Bonneville Act to direct the BPA administrator to enter into hydraulic and electrical coordination agreements with owners of nonfederal generating facilities on the Columbia and tributaries.

BPA studies looking toward adoption of a peaking rate or peaking feature in proposed future demand energy rates.

Expansion of BPA's power sales program to get greater use of federal generating capacity.

BPA to adopt a plan of service to the Vigilante Electric Cooperative (Mont.) and to the Surprise Valley Cooperative (Alturas, Calif.).

The group opposed regulation of consumer-owned electric cooperatives by any state regulatory commission (as reportedly under consideration in Oregon). It also:

Endorsed national policies favorable to low interest rates.

Reaffirmed opposition to Pacific Northwest Account legislation (S-1388).

Favored further study of the Eklutna project (Alaska) by the Bureau of Reclamation.

Endorsed efforts of the Oregon PUD Assn. to obtain changes in Oregon law that would permit issuance of revenue bonds by authority of PUD boards and to broaden provisions for forming and enlarging PUDs, in seeking enactment of an Oregon State Power Commission law, and in seeking legislation to permit Oregon PUDs and cities to establish joint operating agencies.

Dean Barline, director of Tacoma City Light, was elected president of NWPPA to succeed Ivan Laird of Coos-Curry Electric Cooperative. Dan Jolly, Connell, Wash., commissioner of Franklin County PUD, was elected vice-president and Ed Cooney, Castle Rock, Wash., secretary of Cowlitz County PUD, was re-elected treasurer.

Elected new members of the board of trustees were Jack Frisbie, Salem Electric Cooperative; Ed Collison, Ritzville, Wash., Ted Tietzel, Chehalis, Wash., and Paul Rohwer, Anchorage, Alaska. Re-elected to the board were Barline, Cooney, Eugene Pike, Missoula, Mont., Ed Schlender, Malta, Idaho, and Tom Quast, Maryville, Wash.

Wenatchee, Wash., was chosen as the 1961 spring meeting city.

► **Northern California Chapter of NISA** (soon to be known as EASA—Electrical Apparatus Service Assn.) elected Al Dutil of Enterprise Electric Co., San Francisco, as its chairman for 1960 at its April 11 annual meeting. Al Kinney of Marysville was named vice-chairman. Perry Wood of Kuchel & Sievers Electric, San Francisco, the past chairman, was made the new secretary-treasurer to succeed L. H. Hewelcke of North Bay Electric Works, who has been secretary for the past 10 years.

► **Puget Sound Chapter, NISA,** elected Carl Strock, Center Electric Engineering Co. of Tacoma, as chapter president at its March 1 meeting in Seattle. Hal Tingstrom, Tingstrom Electric Co., Centralia, was chosen vice-president; Allen Patchett, Industrial Electric Co., Everett, secretary-treasurer.

► **Western Underground Committee** of all utilities was scheduled to hold its May 12 and 13 meeting at the new Sacramento Municipal Utility District's office building, 63d and S Streets in Sacramento. Problems under discussion included higher voltage supply philosophy discussed by Miles Andrews and Jack Oliphant of Los Angeles Department of Water & Power; standardization of transformers for residential underground systems by H. L. Woodbury, Glendale Public Service Department; review of operating experience of utilities using direct buried power cable by a PG and E engineer; 12-kv delta pad mounted transformer as proposed by Southern California Edison Co., R. C. Blankenburg; and open discussion of developments in residential underground. The Friday session was to be devoted to field trips in the Sacramento area, according to C. W. Greenhill, secretary.

► Pacific General Meeting of **American Institute of Electrical Engineers** will be held at El Cortez Hotel, San Diego, Aug. 9-12, with a program of technical sessions devoted to late developments in most fields of electrical engineering, inspection trips to scientific and industrial installations in the area as well as recreational events.

► **San Diego Chapter, NECA,** recently elected Marvin Howard of Ace Electric Co. as its president; Neville Baker, Baker Electric Co., vice-president; A. W. Meyers, Meyers Electric, treasurer; and W. L. Larson, Elevator Electric Co., Norman Ferguson, California Electric Works and Robert Davies, Davies Electric, as directors. Ferguson is, likewise, District 9 vice-president. The association is enjoying its new office building on First Street, a totally electric building, even to heating and cooling, where K. Sturges is manager. The building contains an ample size board and general meeting room.

► The long-dormant **Electrical Maintenance Engineers Association of Northern California,** organized in 1940, is being reactivated by the group who were not satisfied to be but a branch of the southern California association. The kickoff dinner, attended by 87, in El Cerrito April 7, featured E. E. Carlton, supervising engineer, Division of Industrial Safety, on "Electrical Safety in Industry." The group selected J. J. Singleton, Pacific States Steel Corp., as president pro tem and John Billings, General Electric Co., secretary. Others active in the formation were D. J. Miller, PG and E; K. B. Rymer, G-E; F. W. Gerick, Mare Island Navy Yard; John Kyes, Westinghouse.

(More association news on page 97)

*Trademark

Fine Fanner Superformed Products

"Superforms* are packaged for storeroom convenience" ...SUPERVISOR OF STORES

"The Fanner people understand our store-room problems.

"Their Superformed products are packaged right . . . well identified . . . easy to handle and store . . . don't get mixed up . . . are well catalogued . . . and, they arrive on time."

The thousands of items that must be stocked, and *readily available*, present a tough problem for Store Room Supervisors. Fanner recognizes this, and *cooperates!*

A-1502A

FANNER *Superformed* **with a "PROTECTIVE TWIST"**

ARMOR RODS... Protect long-span T&D lines at supports

LINEGUARDS... Protect short-span T&D lines at supports

PATCH RODS... Repair damaged conductors

TAP ARMOR... Protects conductor at tapping points

FANNGRIPS... For dead-ending strands and conductors

FANNSPLICES... Join two ends of conductor wire

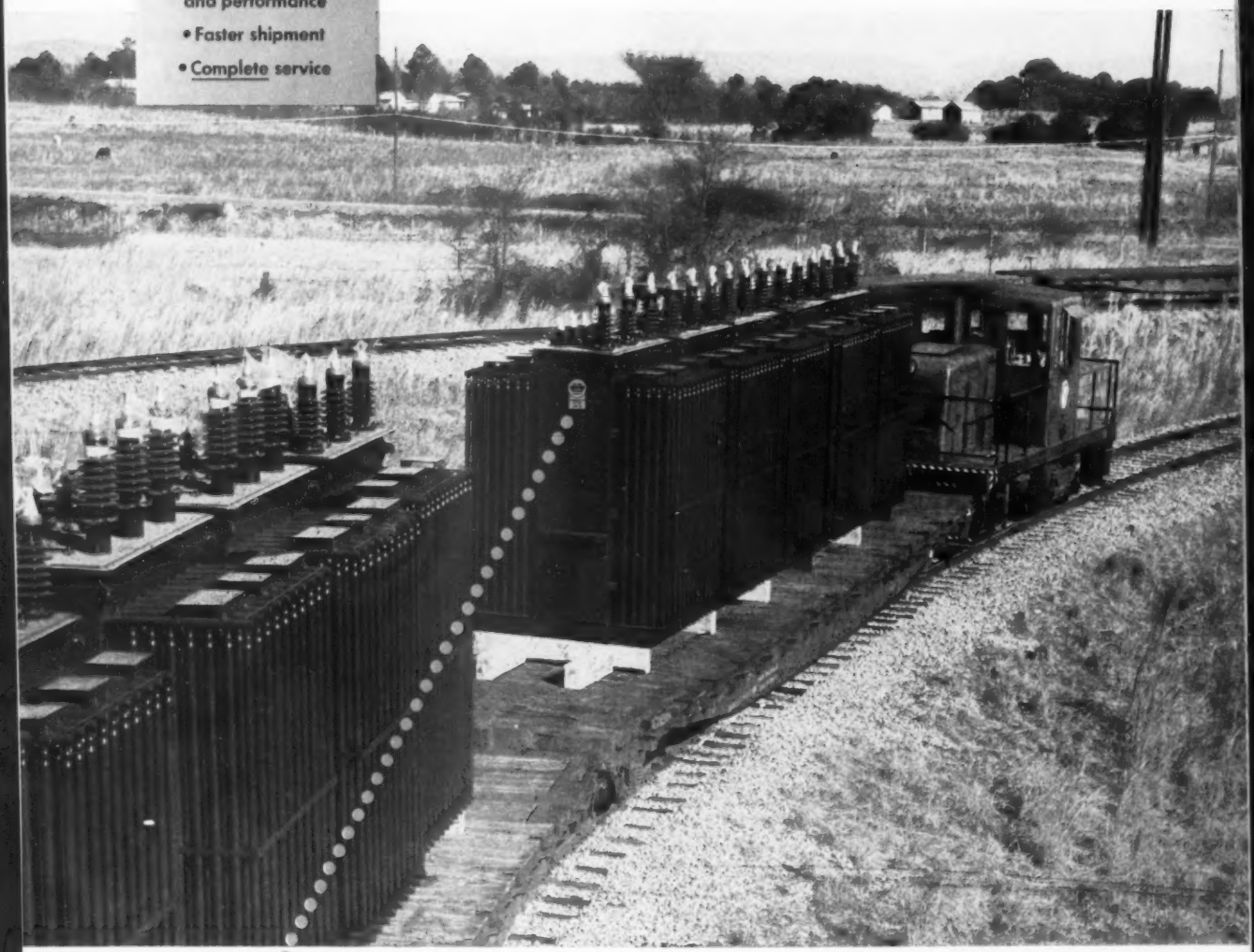
PLASTIC PRODUCTS... For conductor surface protection

FANNER
The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

FULL-VALUE
CERTIFIED
TRANSFORMER
GENERAL ELECTRIC

Transformer

• Superior design, features, and performance
• Faster shipment
• Complete service



SYMBOL OF FULL VALUE

With this seal, General Electric certifies full value for your transformer dollar; full value in terms of superior basic design, features, and performance . . . plus faster order handling and shipment . . plus complete service before, during, and after installation. No other transformer manufacturer can match this complete General Electric package.

shipment now 20% faster

Use of digital computer reduces design time; permits faster production, delivery of General Electric medium transformers

Faster product designing—through the use of a digital computer—now makes it possible for General Electric to reduce medium transformer* shipment schedules by as much as 20 percent.

Single-phase and many smaller three-phase units in the 501- to 7500-kva ratings are now shipped in five weeks! No more than six weeks are required for shipment of the largest standard-design three-phase units.

This faster shipment is the result of General Electric's efforts to reduce time spent in transformer design engineering. Normally, 40 hours of engineering are required for preliminary design —*now, with the computer, it takes just 20 minutes!* On final designs, the computer quickly selects proper sizes for all transformer parts—core, winding and tank. Sizes and weights to best meet specifications for a complete transformer and individual parts are computed in minutes. *This reduction in design time and expense is passed on as a direct shipment and product quality benefit to you.*

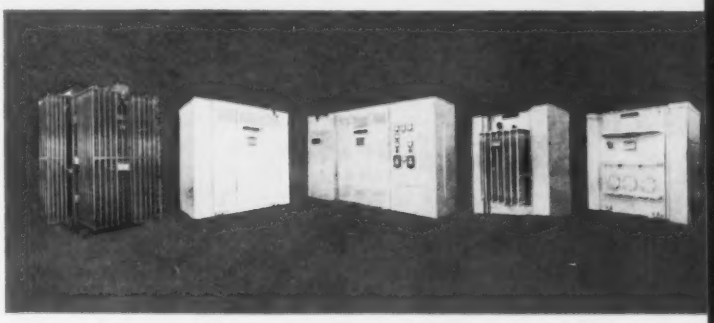
Computer-designed General Electric transformers also feature many basic improvements, including up to 20 percent reduction in height with negligible increase in floor space, and weight reductions up to 8000 pounds.

Ask your G-E Apparatus Sales Engineer to point out the many ways you save time and money with computer-designed transformers—another result of General Electric's *continuing* Certified Full-value Transformer Program. General Electric Company, Schenectady 5, N. Y.

416-30

*501 to 7500 kva, 69 kv and below.

DIGITAL COMPUTER cuts engineering and shipping schedules on G.E. medium transformers, saves customer time and money.

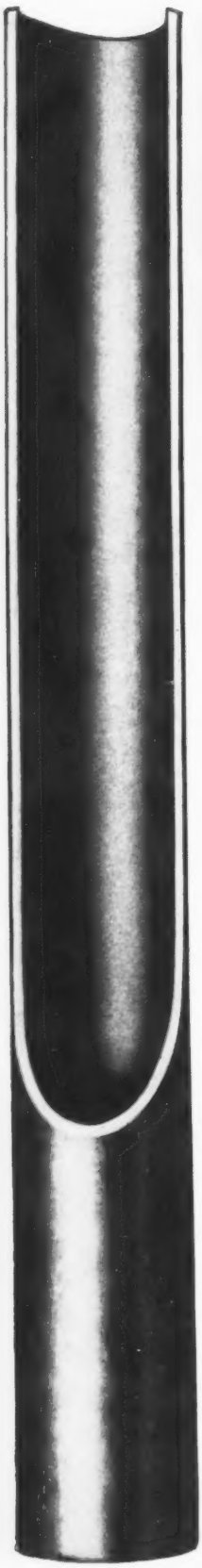


FULL LINE of Full-value Transformers by General Electric—left to right—Medium, Open Dry-type, Integral Distribution Centers, Distribution Equipment and Sealed Dry-type.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For phone number of closest representative see advertising index in back of book.



SPECIFY CLIFTON CONDUIT

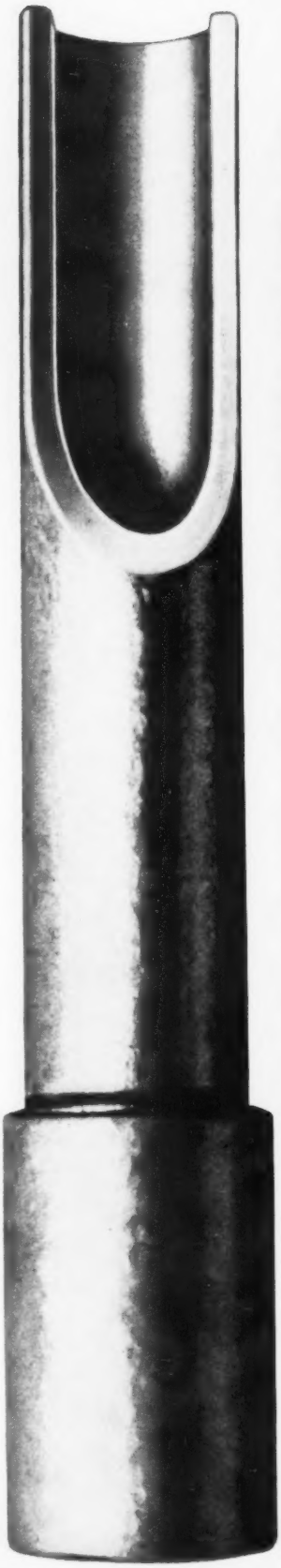
The conduit with built-in quality

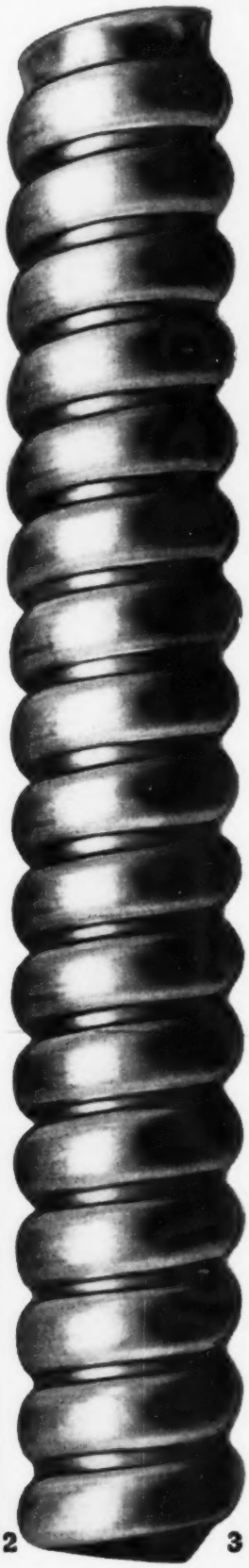
1 **EMT** (Electrical Metallic Tubing) the only hot-dipped galvanized tubing—inside and out for complete protection • flat, clean, continuous weld for smooth interior surface and ease of pulling during installation.

2 **RIGID CONDUIT** made of the finest steel available • Clifton's exclusive process for hot-dipped galvanizing guarantees a uniform zinc protective coating . . inside and out • the finest rigid conduit made. Clifton Rigid Conduit is approved by Underwriter's Laboratories, Inc. and conforms with Federal Specification WW-C581C and ASA Specification C-80.1-1953. Clifton EMT is approved by Underwriter's Laboratories, Inc. and conforms with Federal Specification WW-T-806B and ASA Specification C-80.3-1953. RIGID CONDUIT ELBOWS, COUPLINGS, AND NIPPLES in a full range of sizes • are manufactured of the same fine high quality steel as RIGID CONDUIT • hot dipped galvanized inside and out.

3 **FLEXIBLE STEEL CONDUIT** really flexible and crush-resistant for easier and faster installations • manufactured under Clifton's rigid controls from purchase of high quality steel tape to finished product • smooth inside surface assures you trouble free pulling during installation. Clifton Flexible Steel Conduit is approved by Underwriter's Laboratories, Inc. and conforms with Federal Specification WWC-556. Other quality products by Clifton: Bushed Armored Cable; Unarmored Service Entrance Cable; (CLIFTX) Non-Metallic Sheathed Cable; CLIFTALL-UF; Building Wire —TW, RHW, RR.

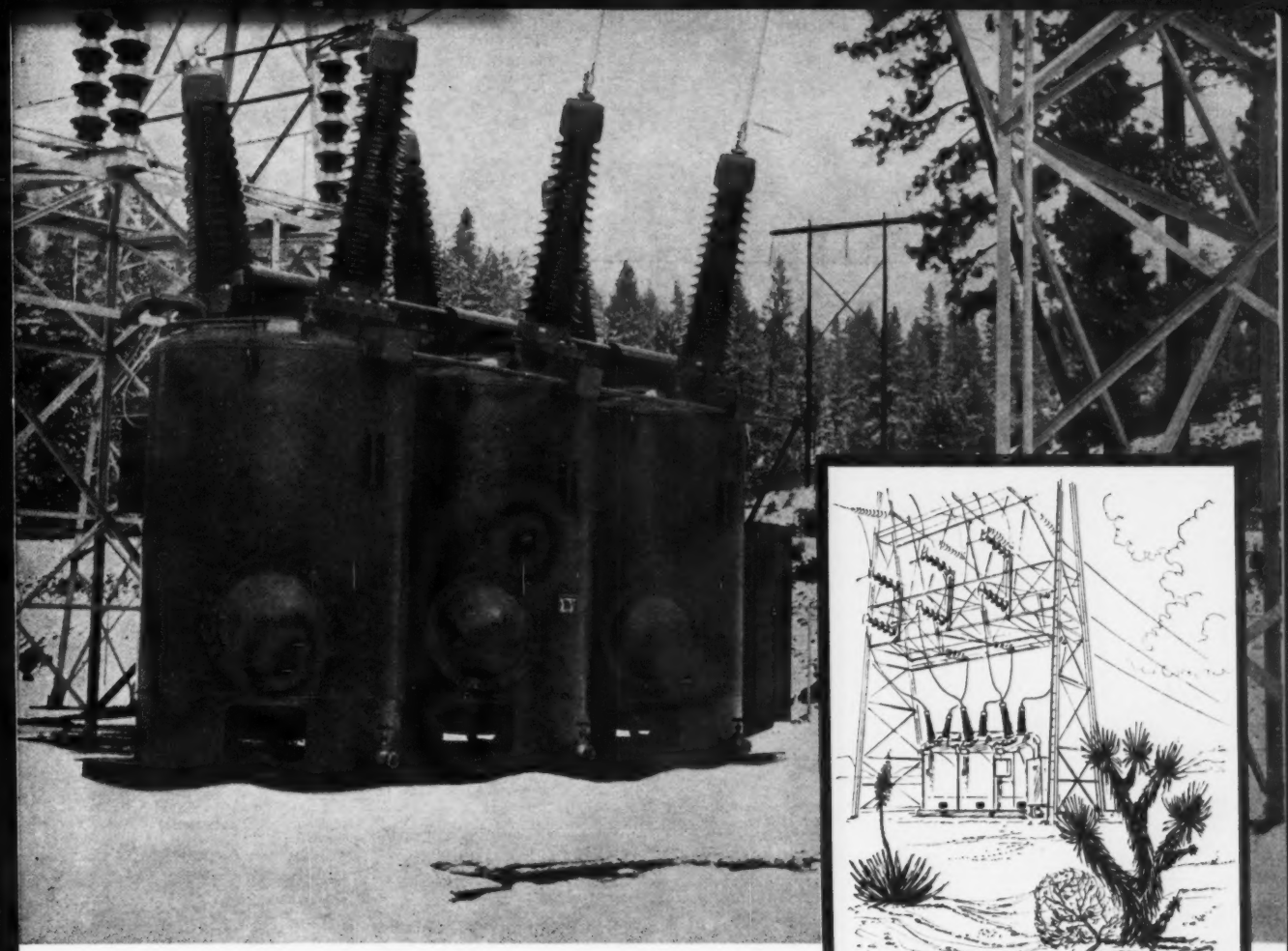
CLIFTON CONDUIT CORPORATION
A Division of General Cable Corporation
3300 Eastbourne Ave., Baltimore 24, Md.

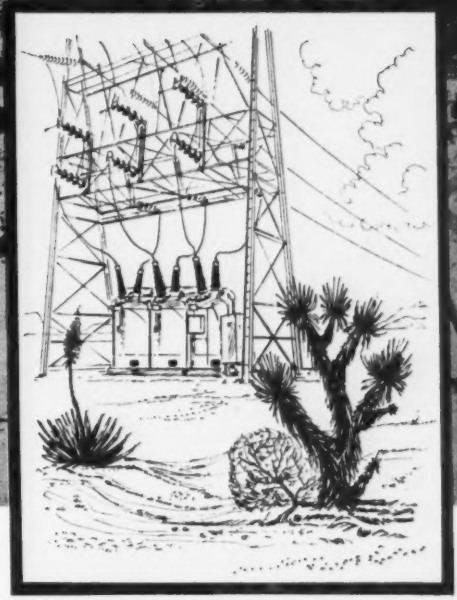




1 2 3

For phone number of closest representative see advertising index in back of book.





I-T-E installations stand up daily to the ravages of—

- the windswept Western deserts
- the freezing Rockies and High Sierras
- the salty Pacific coastline
- the wet forests of the great Northwest

FROM SNOW AND ICE TO SCORCHING SUN...

You'll find field-proven Power Circuit Breakers by I-T-E

For more than 50 years, Kelman power circuit breakers have proved themselves the hard way—successfully standing up under the most rugged environments. Under all kinds of adverse conditions, from snow and ice to desert sand and sun, from whipping rains to fast-changing mountain temperatures, thousands of Kelman breakers have weathered the years and stood the test of time.

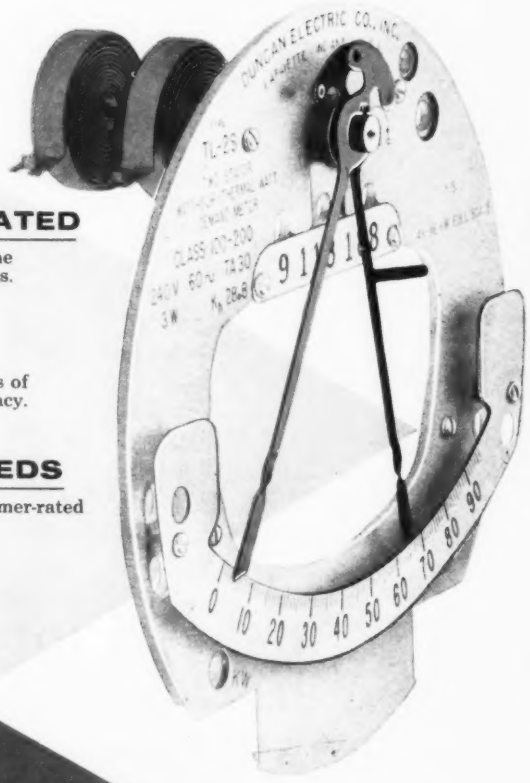
Now part of I-T-E's broad line of established electrical equipment, the latest improved oil breakers from the Power Circuit Breaker Division are offered nationally through all I-T-E sales offices. Available in transmission, subtransmission, and distribution ratings, these breakers stand ready to serve under any conditions anywhere in the United States.

For descriptive literature on I-T-E's field-proven power circuit breakers, write to 1667 North Main Street, Los Angeles 12, Calif., Dept. EWE-961-1.

I-T-E CIRCUIT BREAKER COMPANY
KELMAN POWER CIRCUIT BREAKER DIVISION

For phone number of closest representative see advertising index in back of book.

LOW OVERALL COST DEMAND MEASUREMENT



D **OES IT LOGICALLY**

The Duncan Thermal Demand Meter follows the same general heat-time curve that determines system capacity.

U **NNECESSARY PARTS ELIMINATED**

Long, reliable service is assured by a design using one moving part — moving only when the load changes.

N **O CALIBRATION PROBLEM**

Only one adjustment for up-scale point. Adjustments of the watthour meter do not affect the thermal accuracy.

C **APACITY TO MEET YOUR NEEDS**

Available in a full line of self-contained and transformer-rated meters. Maximum range to 200 amperes.

A **CCURACY MATCHES LOAD**

The Thermal Demand Meter does not split peaks. It measures actual demand.

N **O LARGE INVENTORY**

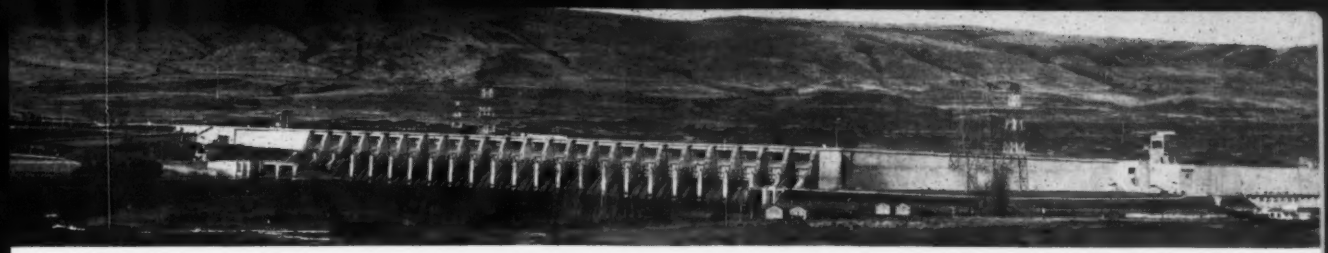
Dual range scale combinations available to cover most rate structures with a minimum of meters.

THERMAL METERS

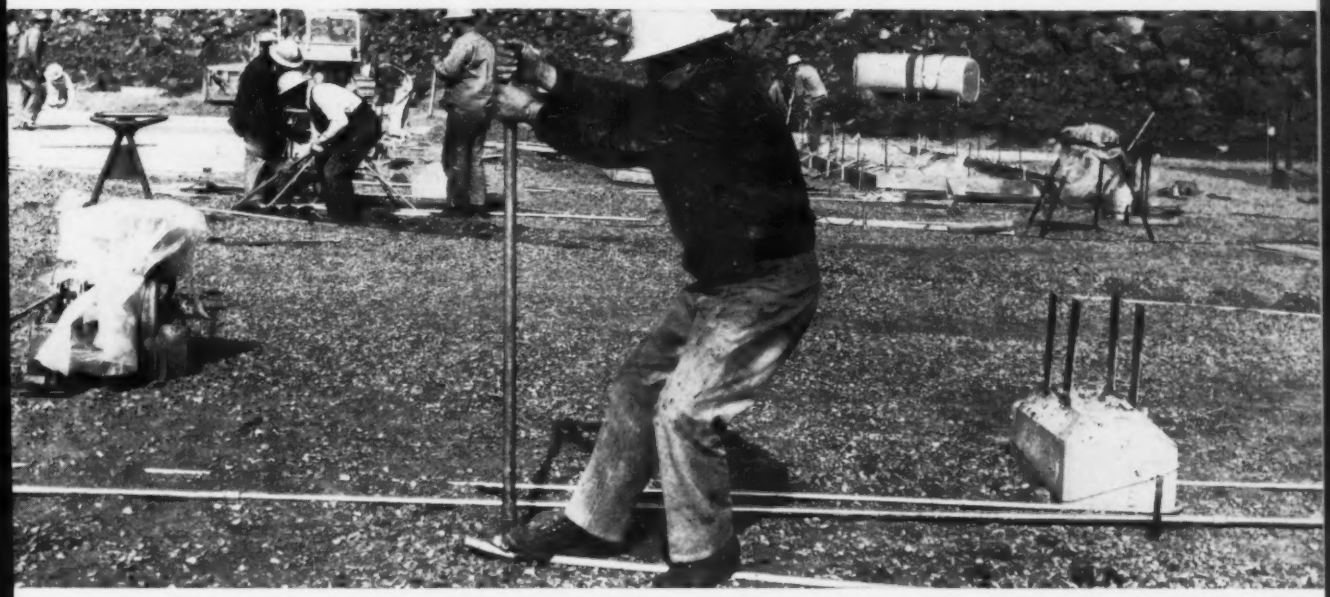
"Thinking Ahead . . . Moving Ahead . . . to stay Ahead of Demand"

WATTHOUR METERS • MOUNTING DEVICES • DEMAND METERS

For phone number of closest representative see advertising index in back of book.



At Oregon's Columbia River Dalles Dam



SPANG® Steel Conduit gets 50-year assignment

in U. S. Corps of Engineers Project Building

The U.S. Corps of Engineers designs and builds on a 50-year life basis. This calls for top-quality materials in every project. Because Pitman Electric Company, electrical contractors on the job, knew dependable SPANG HD Galvanized Conduit and SPANGLEAM EMT would meet these specifications, SPANG was used throughout the Corps' new project building for electric heating, lighting and general power.

SPANG uniformity pays off!

Pitman foreman Bert Bixby reported a smooth installation with SPANG, which was due to the conduit's uniformity. The finish held up perfectly on 90° and "horseshoe" bends. Despite outdoor storage, there was no sign of corrosion on the conduit. Inventory and housekeeping was easier with the special safety bundling of SPANG Conduit packages.

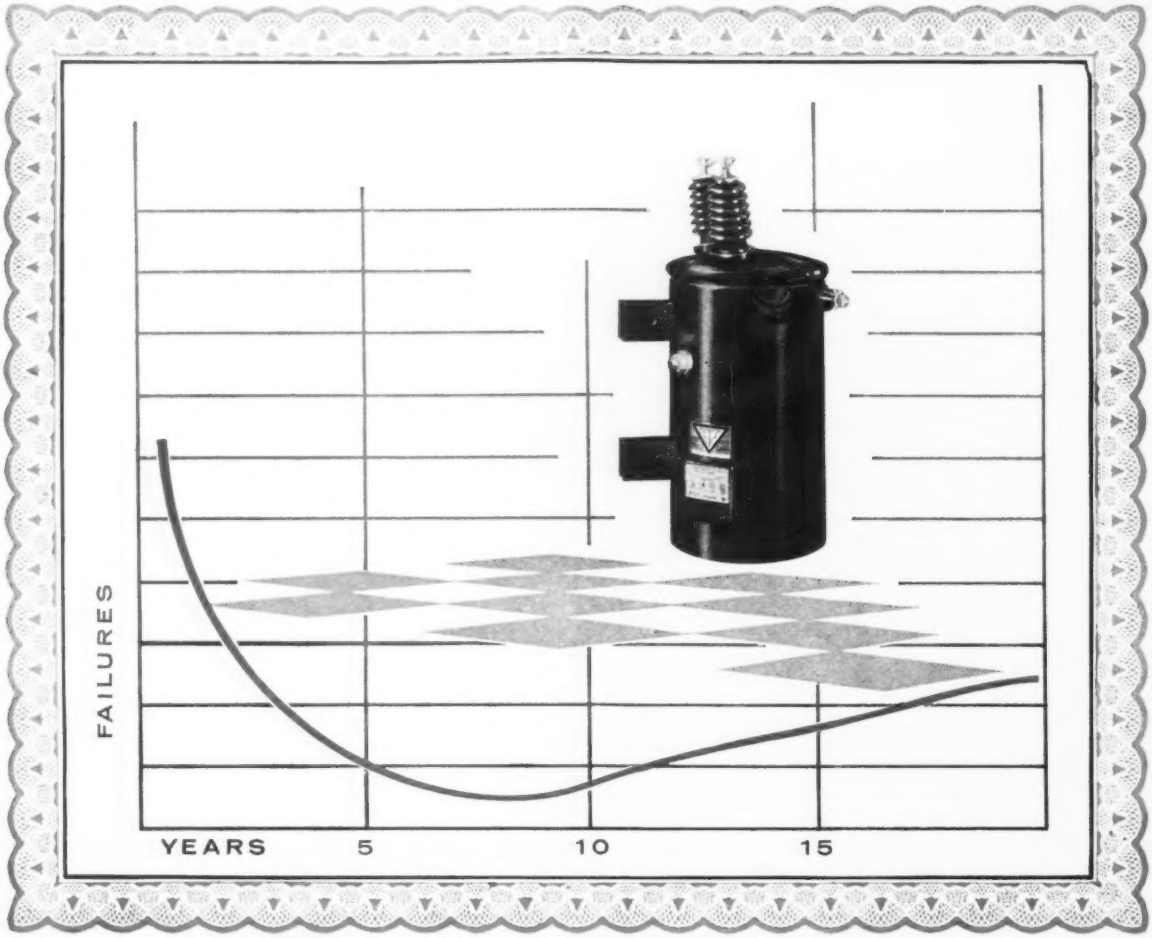
Want dependability? Specify SPANG!

You'll get a trouble-free job with years of built-in dependable service with a SPANG Steel Conduit installation. Next time, tell your local distributor to make it SPANG!

General Contractor: James S. Hickey, Portland, Oregon
Electrical Contractor: Pitman Electric Company, Portland, Oregon
Spang Distributor: Eoff Electric Company, Portland, Oregon

SPANG® CONDUIT

THE NATIONAL SUPPLY COMPANY
Two Gateway Center, Pittsburgh 22, Pennsylvania
Subsidiary of Armco Steel Corporation



GUARANTEED

for 5 years — further proof of the exceptional quality built into every RT&E Transformer to save you money. The wisdom of this guarantee is borne out by the graph above. This typical mortality curve was developed from actual failure rates of one leading utility and covers all makes of transformers. It shows clearly that most transformer failures due to workmanship and materials occur during the first 5 years of use, the critical period covered by the RT&E guarantee.

In addition to this 5 year guarantee against defective materials and workmanship, RT&E also guarantees all fully protected transformers unconditionally for one full year.

RT&E CORPORATION
WAUKESHA, WISCONSIN
PORTLAND, OREGON

EE

For phone number of closest representative see advertising index in back of book.

Gas turbines show their breeding

BROWN BOVERI

By R. L. Steer, Project Engineer, Brown Boveri Corp.

Brown Boveri gas turbines have the "solid" look of steam turbines. The casings are machined castings. The rotor shafts are large. Bearings and other parts are easily accessible. Each turbine has a single, rugged combustion chamber.

This family resemblance comes naturally. Brown Boveri gas turbines were designed from the start for continuous stationary service . . . in contrast to lightweight units adapted from aircraft engine designs.

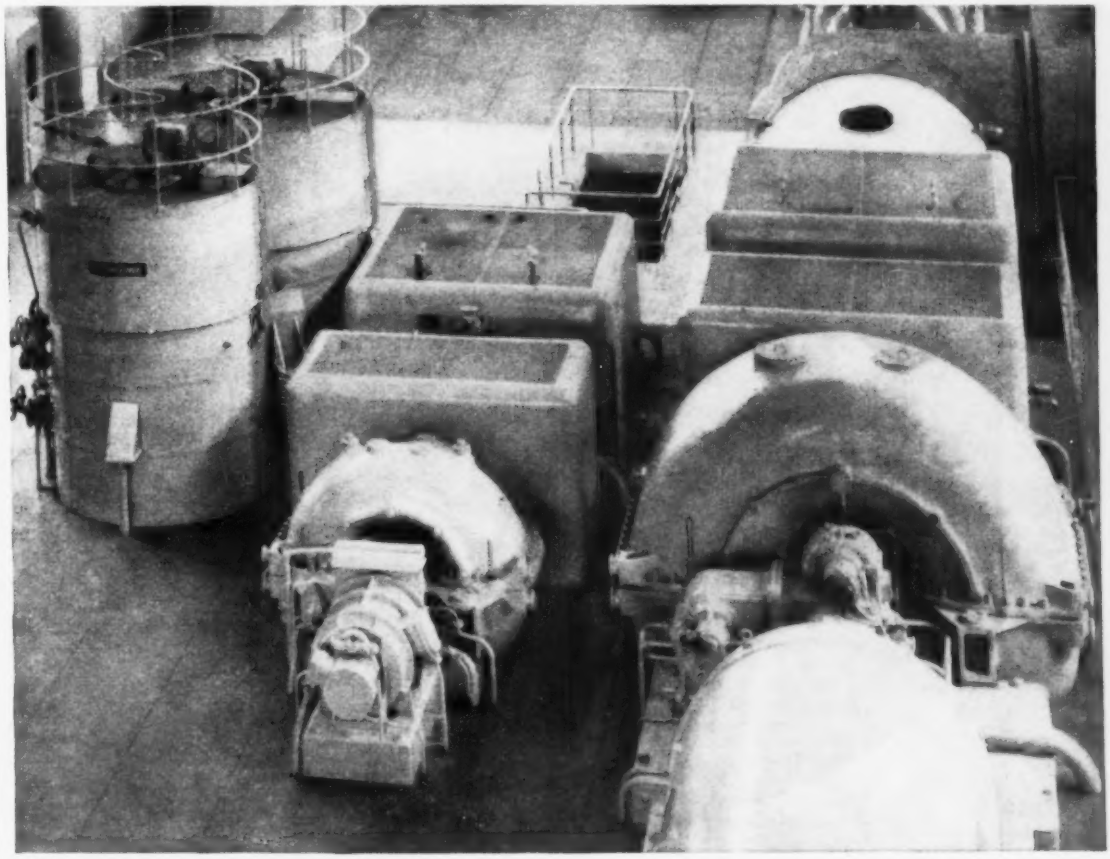
The first large gas turbine-generator, a 4,000 kw unit, was built by Brown Boveri and installed in 1939. It is still operating.

The world's largest gas turbine generating plant at Port Mann, Canada, is unattended! Its four 25mw Brown Boveri units are fully automatic and remote controlled.

Overhaul of two Brown Boveri gas turbine sets at the Pertigalete Cement Works, Venezuela, showed a typical condition: after 15,000 operating hours, components were almost like new. No sign of wear. No repairs or parts changes required.

Scores of Brown Boveri stationary gas turbines totalling over 1,300,000 kw installed capacity are driving generators, compressors and blowers in nearly continuous trouble-free operation—year after year. No other manufacturer can match this experience.

About Brown Boveri gas turbines: Sizes: 1,200 to 30,000 kw output. Single shaft sets for low initial cost. Double shaft, multi-stage units for lowest cost per kw and higher efficiency. Dual burners, quickly adaptable to gas or liquid fuels. Stationary, semi-mobile or mobile mounts. Completely automatic or remote controls.



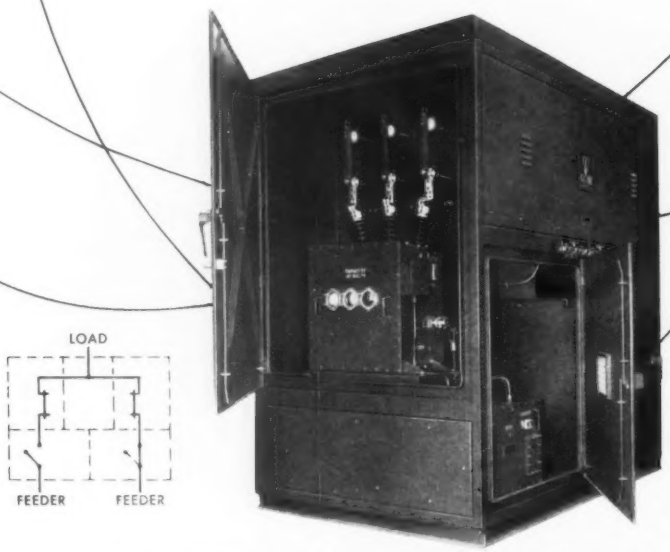
A Brown Boveri two-stage gas turbine. This turbine drives a 25 mw generator part of which is visible at the lower right corner of the photo. Starting time from cold to full load is less than 20 minutes.

BROWN BOVERI Brown Boveri Corp., Dept. EL5, 19 Rector Street, New York 6, N. Y. Agents in 27 U. S. cities.

For phone number of closest representative see advertising index in back of book.

positive
power protection
for nuclear
energy tests
provided by

G & W SWITCHGEAR
(UNICLAD)



In one of the nation's foremost atomic energy laboratories, positive protection against power interruptions is provided by G&W UNICLAD SWITCHGEAR. This protection is accomplished through a dual arrangement of preferred and emergency feeder controlled G&W Load Break Oil Switches incorporating three types of operation — automatic, semi-automatic and manual. This arrangement incorporates standard G&W switches, 15 kv, 400 ampere continuous and load break, 110 kv BIL, 20,000 ampere RMS momentary, with potential transformers, current transformers and blocking relays.

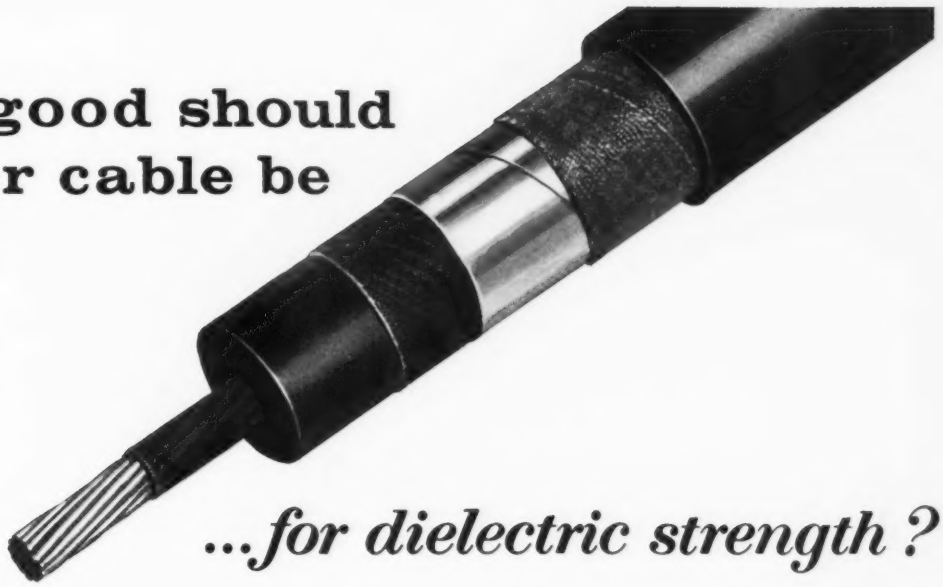
Details of this installation cannot be fully divulged here. However, your near-by G&W representative will assist you in adapting these principles to your specific transmission or distribution problem. You can be assured of the engineering ingenuity and quality craftsmanship that go into all G&W Potheads, Cutouts, Load Break Oil Switches and Custom Built Switchgear . . . typical reasons why G&W has been a leader in its field for over 55 years.

G&W ELECTRIC SPECIALTY COMPANY
3506 WEST 127TH STREET • BLUE ISLAND, ILLINOIS
CANADIAN MFR. • POWERLITE DEVICES, LTD. • TORONTO, MONTREAL & VANCOUVER

U60-1

For phone number of closest representative see advertising index in back of book.

how good should power cable be



...for dielectric strength ?

At CIRCLE, the point is not how well specifications are met—but rather *how far they can be exceeded!* Take, for example, the well-known "double voltage test" as required by IPCEA-NEMA.

IPCEA-NEMA Performance Requirements

"6.5.3 After the sample has been immersed for at least one hour, it shall withstand for 5 minutes a test voltage which is twice the test voltage given in Table 12."

"6.5.4 . . . starting with the voltage at which the test described in 6.5.3 was made, the voltage shall be raised in steps of approximately 20 per cent of the immediately preceding voltage until failure occurs, the voltage to be kept constant at each step for 5 mintues."

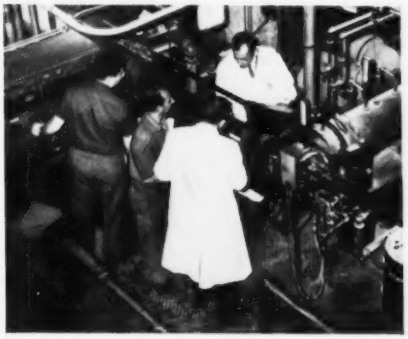
"Circlesheath® Type RR Power Cable Performance"

The following table describes the performance of three samples of Circle butyl-insulated Type RR power cable.

CABLE SIZE	RATED VOLTAGE	DOUBLE AC TEST VOLTAGE	CIRCLE B'KDN VOLTAGE	MAXIMUM STRESS IN VOLTS PER MIL
2 AWG	5KV	28KV	48.3KV	454
1/0 AWG	5KV	28KV	40.3KV	356
500 MCM	5KV	31KV	44.6KV	307

A Circle power cable, subjected *for over two years* to a 250% overload of rated voltage in a *test still in process,* continues to meet all specified requirements.

A frequent sight at Circle is the checking of extruder operation by laboratory technicians. They are concerned with seeing that the quality they build into a cable in the lab is realized on the production line.



Turning out high-reliability power cable requires expert knowledge of compounds, absolute quality control—and men who *know enough* to produce the very best. Next time you specify power cable, ask for Circle—there's no finer made.

CIRCLE WIRE & CABLE
a subsidiary of
CERRO DE PASCO CORPORATION

RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE •
PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE® EMT

69KV-T.R. No. 216
Locke® Cat. No. 29069

General Electric announces
STATION POST INSULATORS
with WIDE HOOD SPACING

- **breaks up drip stream**
- **eliminates heavy corona**
- **permits natural cleaning**
- **simplifies hot line washing**
- **improves effectiveness of NEMA leakage distances**

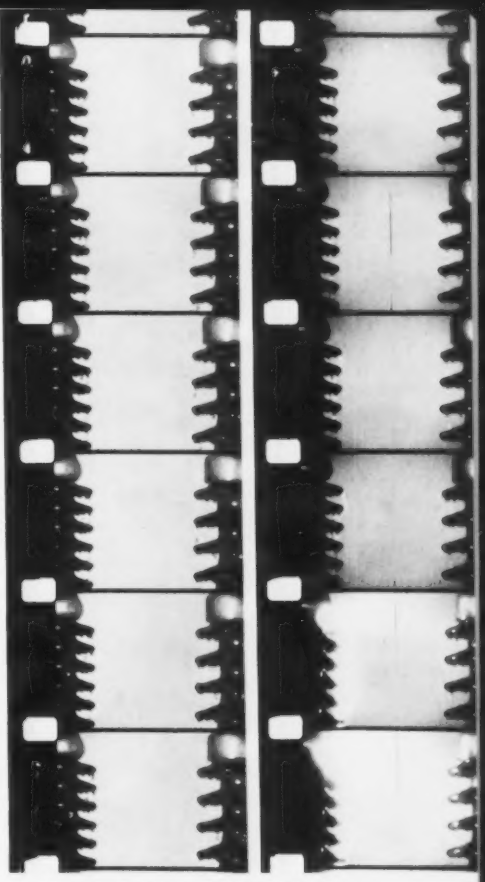
General Electric now offers you the first line of Station Post Insulators, 7.5 KV through 69 KV, that provides complete and effective utilization of the NEMA standard leakage distances. The new **wide hood** spacing has been scientifically proportioned to break up drip streams that normally gap old fashioned posts of narrow hood spacings. Note in the unretouched high speed movie strips, used by the design engineers, the effectiveness of the wide hood spacing.

Comparative tests between the **wide hood** spacing and the old fashioned station posts during rigidly controlled laboratory conditions clearly demonstrate the design problem is not merely *how much leakage distance* . . . but also, *how effective is the leakage distance?*

Sequential photographs, as shown at the right, vividly illustrate the superiority of the new station post for breaking up the drip stream, eliminating heavy corona, and promoting effective natural washing. The **wide hood** spacing facilitates convenient hot line washing of the insulator's hoods and barrel.

These **wide hood** station posts have been specifically designed to provide the quality characteristics you need and should expect from modern, advanced engineering and manufacturing techniques.

Obtain complete information from your Insulator Department representative — —or write for bulletin TIA-172, Insulator Department, General Electric Company, P. O. Box 57, Baltimore 3, Maryland.



Actual laboratory films available for showing.

Photographs at left (4000 frames/min.) show the sequence of droplet formation on our new wide hood spacing and older station post designs. Note the superiority of the new post in retarding bridging action and in breaking up the drip stream under actual line potential.

The right hand photographs taken under identical precipitation, (ASA standard wet test), show the pre-flashover corona streamers on the top hoods of the old fashioned post. Bridging action has reduced the effective leakage path and created localized voltage stress. A fraction of a second later, 60 cycle flashover occurs on the old fashioned post.

EEI-NEMA STANDARD

*Trademark General Electric Co.

46KV-T.R. No. 214
Locke Cat. No. 29046

34.5KV-T.R. No. 210
Locke Cat. No. 29034

23KV-T.R. No. 208
Locke Cat. No. 29023

15KV-T.R. No. 203
Locke Cat. No. 29015

7.5KV-T.R. No. 202
Locke Cat. No. 29007

Progress Is Our Most Important Product

GENERAL ELECTRIC

Industry-proved through a quarter century of service...THERE'S NO DOUBT ABOUT NEOPRENE

Now you can zip through Baltimore at 45-60 mph—even at night. A total of 826 powerful fluorescent lights brighten the roadway, make high-speed driving safer. Neoprene jacketing was specified for over a million feet of illuminating cable used in this installation.

OVER A MILLION FEET OF NEOPRENE-JACKETED CABLE ILLUMINATES BALTIMORE EXPRESSWAY

Tough, pliant, abrasion-resistant neoprene meets Maryland Roads Commission specifications

The Baltimore Harbor Tunnel Expressway—16 miles of limited access dual lane highway—uses over a million feet of illuminating cable . . . and every foot of that cable is jacketed with durable neoprene synthetic rubber. Neoprene-jacketed cable, supplied by Walker Brothers, met specifications set down by the Maryland Roads Commission for lighting cable with a "tough, pliant, abrasive-resisting sheath."

Neoprene jacketing combines toughness and abrasion resistance with many other desirable qualities. It resists weathering, chemicals, temperature extremes and deformation from cable clamps. It has proved—in actual service—that "neoprene jacketing" means long, economical protection for electrical cable. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department EW-5, Wilmington 98, Delaware.

DU PONT REG. U.S. PAT. OFF. NEOPRENE SYNTHETIC RUBBER

Better Things for Better Living . . . *through Chemistry*

WIN A HAWAIIAN HOLIDAY

in the HOTPOINT MEDALLION HOME PROGRAM

MEDALLION HOME® LIVE BETTER ELECTRICALLY

A fun-filled trip to America's Paradise in the Pacific awaits power supplier representatives in the Hotpoint Medallion Home Program. This dynamic advertising and merchandising program is power-packed to help you turn more builders into Medallion Home builders.

Hotpoint backs up this tremendous load-building program with the quality appliances the public prefers plus .... 1960's greatest boost to all-electric living...

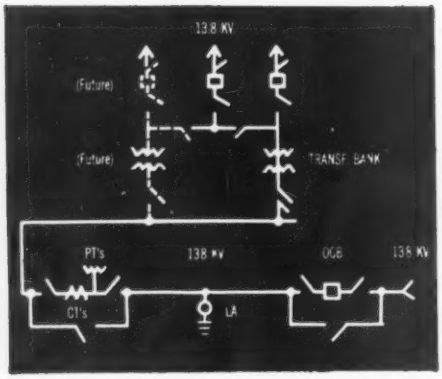
NEW HOTPOINT ELECTRIC BASEBOARD HEATING WITH CALROD® HEATING UNITS

Hotpoint offers the load-building benefits of electric heating – clean, safe, comfortable, convenient, economical – plus the proven performance of famous Calrod heating units. Call your Hotpoint distributor today for complete details on new Electric Baseboard Heating, the Hotpoint Medallion Home Program, and your Hawaiian Holiday.

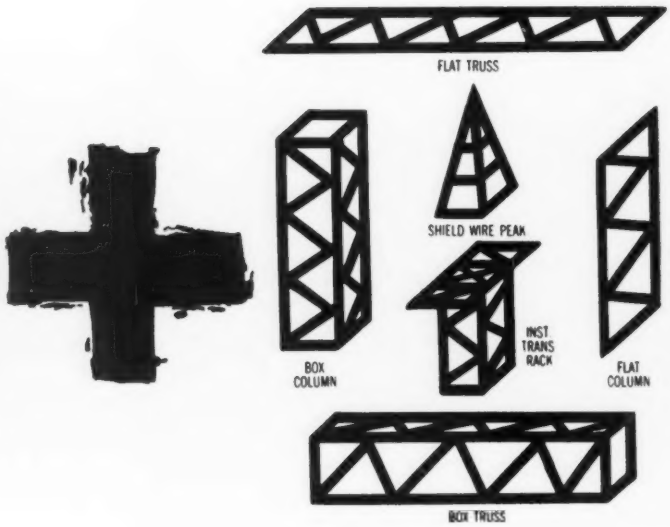
Hotpoint

A Division of General Electric Company, Chicago 44, Illinois

ELECTRIC RANGES • REFRIGERATORS • AUTOMATIC WASHERS • CLOTHES DRYERS • CUSTOMLINE® • DISHWASHERS
DISPOSALLS® • WATER HEATERS • FOOD FREEZERS • AIR CONDITIONERS • ELECTRIC BASEBOARD HEATING



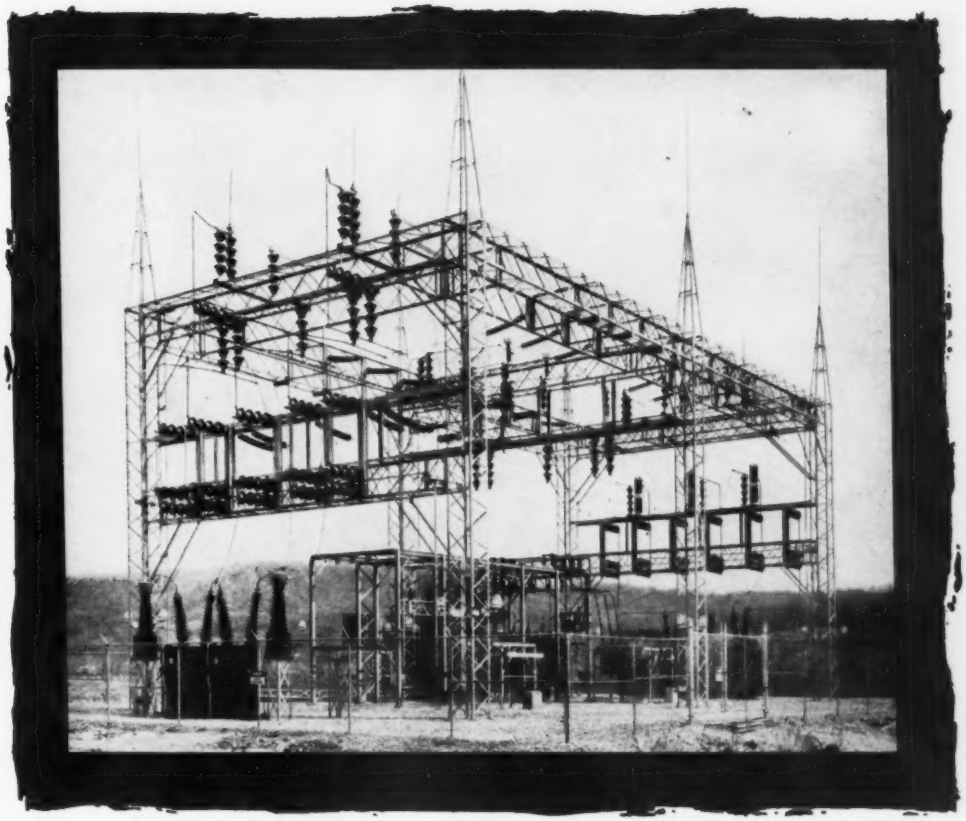
STATION DIAGRAM



NOW... LET WESTINGHOUSE STANDARD STRUCTURAL COMPONENTS REDUCE YOUR OUTDOOR SUBSTATION COSTS

• **A few standardized components** permit an unlimited variety of lower cost station arrangements.

• **Save your design time . . .** just send us the station diagram and Westinghouse will design your substation with standard components.



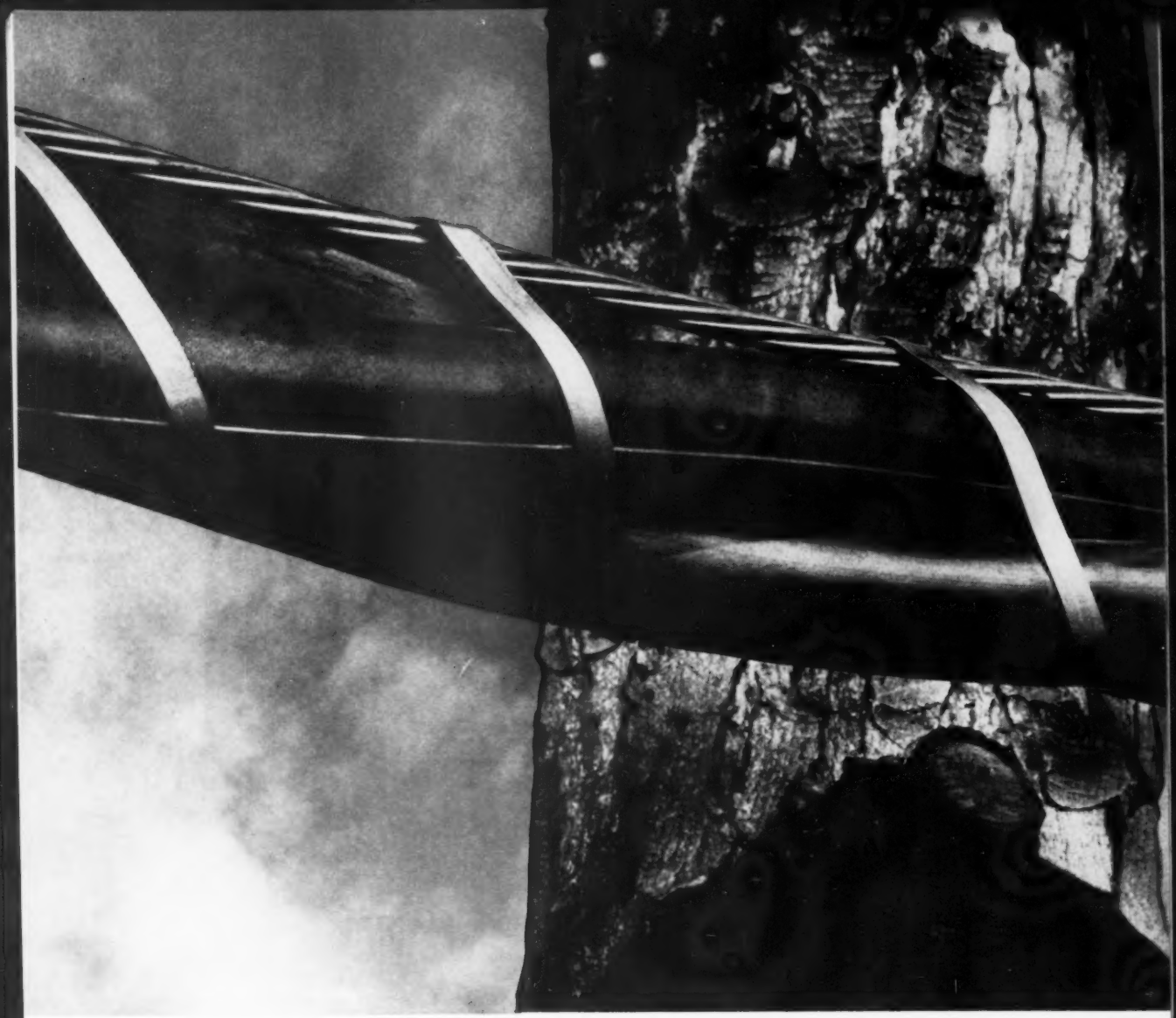
ADDITIONAL ADVANTAGES:

- **Outstanding Product Integration . . .** structure designers coordinate with equipment designers for single-manufacturer responsibility and single-order coordinated delivery.
- **Efficient Use of Steel . . .** maximum strength with minimum weight through proper choice of pre-designed components.
- **Simplified Field Assembly and Erection . . .** all components use interchangeable members—a few bundles of steel instead of many.
- **Uniform Structural Components . . .** give clean, uncluttered appearance to the complete station. Compact design requires minimum plot area.

Investigate this complete Turnkey Plan. Westinghouse assumes full responsibility for the satisfactory operation of the complete substation. Ask your Westinghouse sales engineer for all the facts, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60092-R

YOU CAN BE SURE...IF IT'S **Westinghouse** WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV ALTERNATE FRIDAYS

For phone number of closest representative see advertising index in back of book.



Blaze a smaller path!

Running a power line through a dense tree area can be a costly job!

With open-wire systems, the path you clear must be a broad one. Otherwise extra-long poles are necessary. Either way costs you plenty.

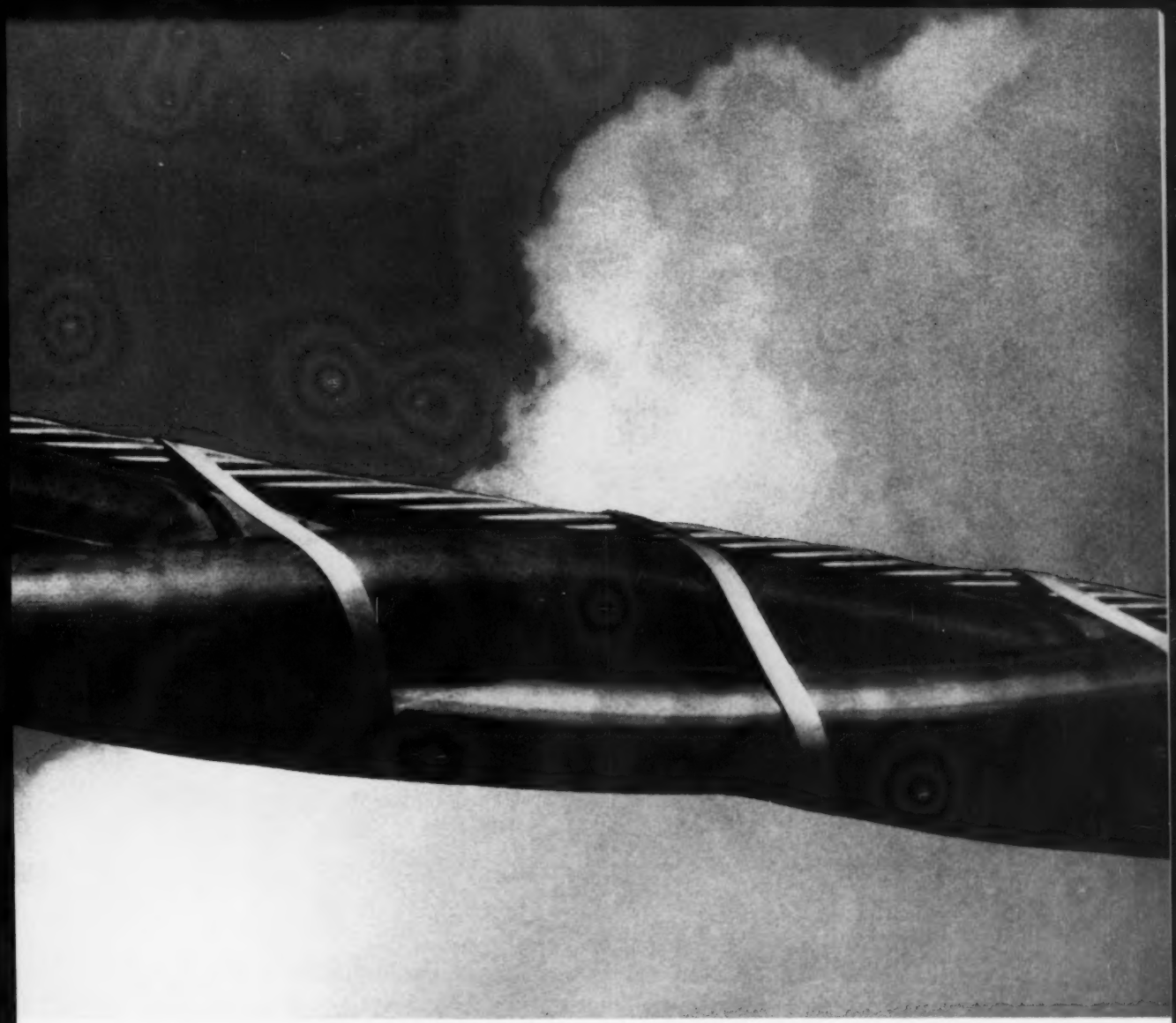
With Rome's reverse-lay preassembled aerial power cable, less tree clearance is required, so you do less tree trimming—initially *and* periodically. Rome aerial cable has a built-in, high-strength messenger for staunch support—capable of supporting falling branches and even trees.

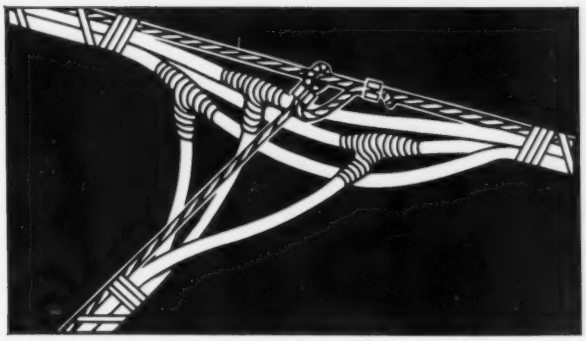
For instance—you need not clear as much of a right of way *initially* as you would for open-wire systems. And you can put off *periodic* tree trimming for as long as five years, compared to the normal two-year requirement for open-wire systems.

Because each conductor is fully insulated and jacketed for maximum resistance to moisture and tree abrasion, reverse-lay aerial cable reduces the chance of outages during storms and high winds. There's no chance that wet branches will cause shorting between phases. And it's safer for your line crews to handle during storms . . . safer for the public too!

In residential areas, preassembled aerial cable gives you two *more* advantages. You avoid situations in which the public might feel you are "defacing" property by excessive tree trimming. And, because it's compact, aerial cable makes a neat, uncluttered appearance—less likely to bring complaints.

You can get Rome's preassembled reverse-lay aerial power cable in a wide range of constructions, rated up to 15 KV: Rozone (oil-base) or Rozone A (butyl-base) insulation, Roprene (polychloroprene) or Roseal (flame-retardant polyethylene) jacketing. Mail the coupon, now!





Ease of tapping Long spans sometimes make mid-span tapping necessary. Rome's reverse-lay preassembled aerial cable construction—where the direction of lay of conductors is reversed at regular intervals along the line—permits easy mid-span tapping. The reversed portions provide sufficient "slack" for taps *anywhere* along the line! This eliminates the necessity of making taps at the pole ends only. Stress is carried entirely on the messenger. Conductors can be untwisted for tapping without cutting—even while the line is hot! Your linemen can use wire guards and rubber blankets for safety and make pole-end taps without use of a platform.

Better voltage regulation Because of its close geometric spacing as compared with open-wire circuits, aerial cable has a lower reactance. Voltage drop is about half as great as typical crossarm construction and, for a given voltage drop, power can be transmitted twice as far.

ROME CABLE
DIVISION OF **ALCOA**

Department 4-50, Rome, N. Y.

☐ Please send me more information on the above.

Name .....

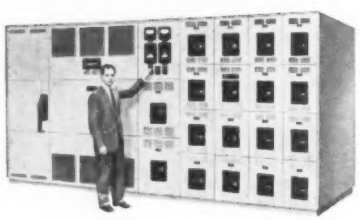
Title .....

Company .....

Street .....

City ..... Zone ..... State .....

"But I was positive we didn't need another substation!"



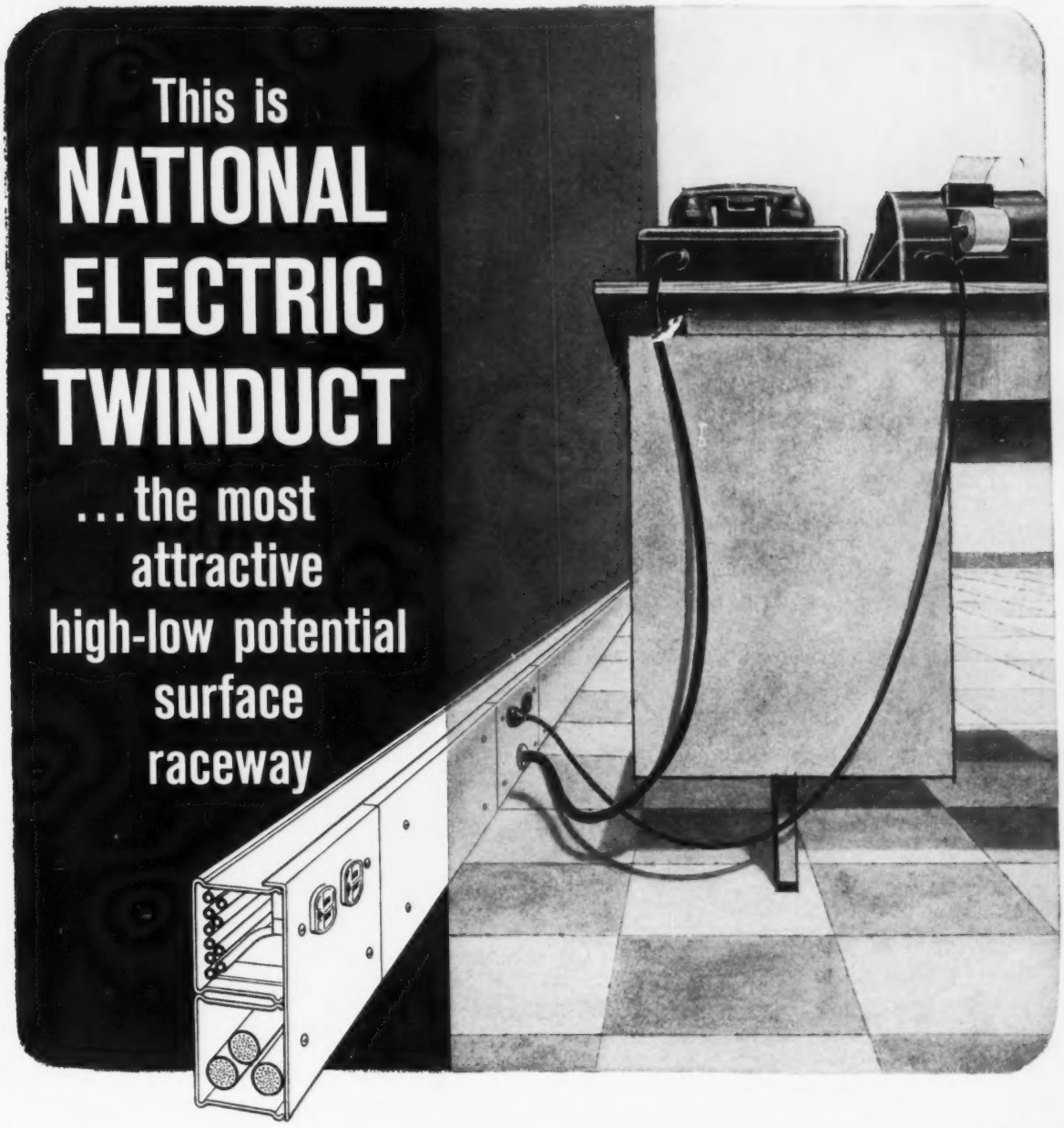
MORAL: For good voltage regulation and better operating efficiency, put a secondary unit substation in each load area. And for complete information on today's most value-packed line of substations, write for Bulletin 3104-1A, I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton Street, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

For phone number of closest representative see advertising index in back of book.

This is NATIONAL ELECTRIC TWINDUCT

...the most attractive high-low potential surface raceway



Neat, modern-looking "Twinduct" Surface Raceway provides both high and low potential service under a *single* cover. Recessed, or surface-mounted "Twinduct" is the most attractive surface raceway for providing complete electrical services in office buildings, apartments and other commercial buildings.

"Twinduct" is not only attractive, but easy to install; offers large, unobstructed wiring areas; and has ½" and ¾" knockouts and mounting holes on 15" centers. Wires are simply "laid in," secured with twist-in steel bridges, and the cover screwed on—fast and easy installation.

"Twinduct" is but one of a complete system of National Electric "lay in" surface raceways which fit every electrical application involving loads from 15 to 60 amps. For complete information, write to *National Electric Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pa.*

NATIONAL ELECTRIC DIVISION PORTER **H.K. PORTER COMPANY, INC.**

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

For phone number of closest representative see advertising index in back of book.

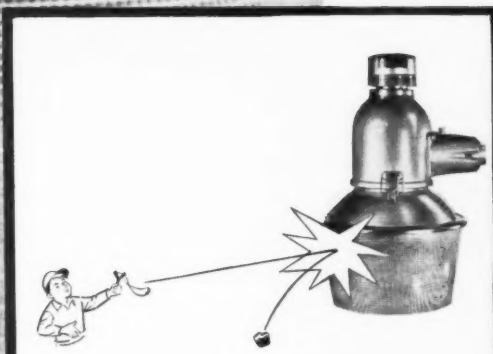
GENERAL ELECTRIC'S

Boosts by

"PRIVATE-LIGHTING" PACKAGES Especially for "private-lighting" applications, General Electric offers the Acrylic-Suburban luminaire in attractively priced equipment packages:

Cat. No. C648G017– Acrylic - Suburban luminaire complete with cadmium-sulphide photoelectric control, acrylic refractor, hood with 175-watt built-in ballast (lamp not included), 4-foot aluminum bracket.

Cat. No. C648G016– Acrylic - Suburban luminaire complete with cadmium-sulphide photoelectric control, acrylic refractor, hood for up to 6000-lumen filament lamp, mogul base, 7-inch light center (lamp not included), 4-foot aluminum bracket.



BB's and stones bounce off

NEW ACRYLIC-SUBURBAN LUMINAIRE

"private-lighting" profits cutting maintenance costs

Exclusive shatter-resistant plastic refractor tops money-saving features

Here's a luminaire designed and built to keep your maintenance trucks in the garage, and your "private-lighting" accounts on the profit side of the ledger. It's the new General Electric Acrylic-Suburban.

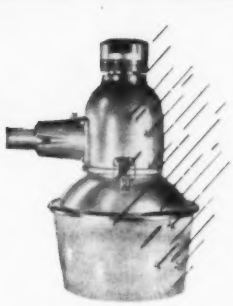
Realizing that repeated service calls can severely hamper any rural and suburban lighting program, General Electric has built into the Acrylic-Suburban these time- and money-saving features:

- The industry's first-and-only open refractor of durable plastic—virtually unbreakable in normal service—developed from General Electric's years of experience with acrylic refractors for mercury luminaires such as the M-250. This precision-molded refractor is more costly to make than glass and offers more resistance to all causes of breakage, yet you pay *no premium* in price. It has the same high transmissivity as glass, and is interchangeable with many standard glass refractors. One-fourth the weight of glass, it's far easier to install.
- General Electric's dependable cadmium-sulphide photoelectric control, which mounts right on the locking-type hood for automatic dusk-to-dawn operation. It's built and tested for years of reliable, trouble-free performance.
- Long-life ballasts built right into the hood for mercury lamps up to 250 watts (hoods without ballast for up to 6000-lumen filament). Since mercury lamps generally last two to three times longer than filament, this means far fewer service calls for relamping.

It all adds up to a luminaire you can install and forget. Whether it's for suburban streets, commercial establishments, or areas around private homes and farms, the General Electric Acrylic-Suburban can mean increased lighting profits for you. For full details and immediate shipment from stock, call your General Electric Apparatus Sales Engineer or Agent. General Electric Company, Outdoor Lighting Dept., Hendersonville, North Carolina. 460-01

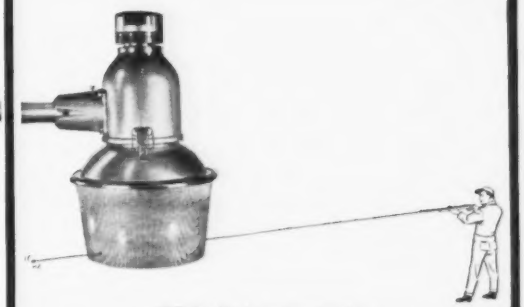
Progress Is Our Most Important Product

GENERAL ELECTRIC



resists thermal shock of cold rain

unaffected by corrosive atmosphere or blowing sand



.22 bullets penetrate but will not shatter

Are the appliances you want most in the new home you plan to buy?

Every MEDALLION HOME has an all-electric kitchen with electric range and oven—and more from this list of additional appliances:

Electric DRYER
Electric WASHER
Electric DISHWASHER
Electric REFRIGERATOR
Electric WATER HEATER
Electric GARBAGE DISPOSER

The Medallion award on a new home guarantees you major electrical appliances, already installed. And you get ample wiring ... full Housepower for future needs ... *plus* lighting which is both functional and beautiful.

So look for the Medallion—national symbol of better housing and modern electric living. It identifies today's best new-home buys in every style, size, location and price range. No family should buy a home without the Medallion Home award.

SOUTHERN CALIFORNIA Edison COMPANY *helps you* LIVE BETTER—ELECTRICALLY

ONLY ADVAN guard

ADDS YEARS TO BALLAST LIFE

THERMALLY PROTECTED FLUORESCENT LAMP BALLASTS

Safeguard Against Both Excessive Temperature and Excessive Current

NOW PROVED BY USE IN HUNDREDS OF INSTALLATIONS EVERYWHERE

ADVAN-GUARD,® a thermally actuated automatic reclosing protective device, introduced by ADVANCE almost 3 years ago, is an integral part of every ADVAN-GUARD® Ballast. It is sealed in the ballast housing and pre-set to instantly and automatically trip out whenever the ballast is operating at higher than recommended temperatures. When heat decreases to normal operating temperature, ADVAN-GUARD resets automatically and the ballast resumes operation. ADVAN-GUARD,® by maintaining normal operating temperatures, adds years to ballast life . . . For years of trouble-free operation of any lighting installation, insist on ADVANCE Ballasts with exclusive ADVAN-GUARD® built-in protection.

ADVAN guard • **Prevents Ballast Operation at abnormal temperatures.**

ADVAN guard • **Protects against excessive voltage supply.**

ADVAN guard • **Prevents internal ballast short circuiting.**

ADVAN guard • **Safeguards in cases of inadequate lamp maintenance.**

ADVAN guard • **Maintains normal ballast operating temperatures.**

ADVAN-guard is listed by Underwriter Laboratories, Inc.

ADVANCE® TRANSFORMER CO.

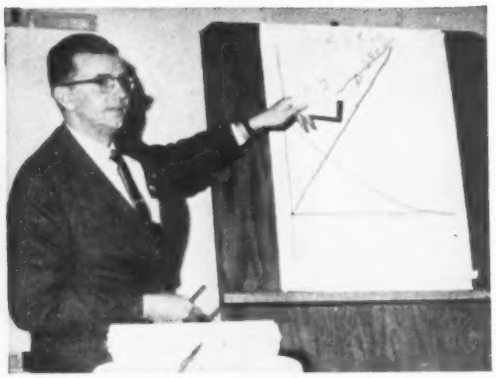
CBM CERTIFIED

World's Largest Exclusive Manufacturer of Fluorescent Lam - Ballasts

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

Manufactured in Canada by: Advance Transformer Co., Ltd. 5780 Pare Street, Montreal, Quebec, Canada

For phone number of closest representative see advertising index in back of book.



"Rochester Gas & Electric realizes annual savings of $.80 kvar with Secondary Capacitors"

*Harry G. Saddock, Rochester Gas & Electric Co.
Rochester, N. Y.

"We have approached the problem of justifying secondary capacitors from several different angles . . .

"An analysis of the economics of secondary capacitors from the standpoint of released capacity showed an annual saving of 50¢ per kvar per year exists at low densities.

"We also considered the secondary capacitor from a loss reduction viewpoint, and have concluded that secondary capacitors nearly pay for themselves from losses alone on 90% p.f. secondaries, and save an additional 50¢ per kvar per year at 80% p.f. Our study indicated that, in both instances, the first unit is the most beneficial . . . so that small-size secondary capacitors scattered uniformly over the system would be the ideal economic solution from the loss reduction standpoint.

"Then, we studied the economics of secondary capacitors from the viewpoint of voltage revenue gain. This study showed that the saving in dollars per kvar of secondary capacitors is about 40¢ per kvar.

"The advent of the meter socket type capacitor has also shown us a way to minimize all the important engineering time in application of our base capacitors. A good percentage of our base kvar may be supplied without sacrificing our diminishing pole space, without costly engineering time, and with a substantial annual savings, besides."

**A reprint of Mr. Saddock's paper, presented at the Second Annual Sangamo Capacitor Seminar, is available on request.*

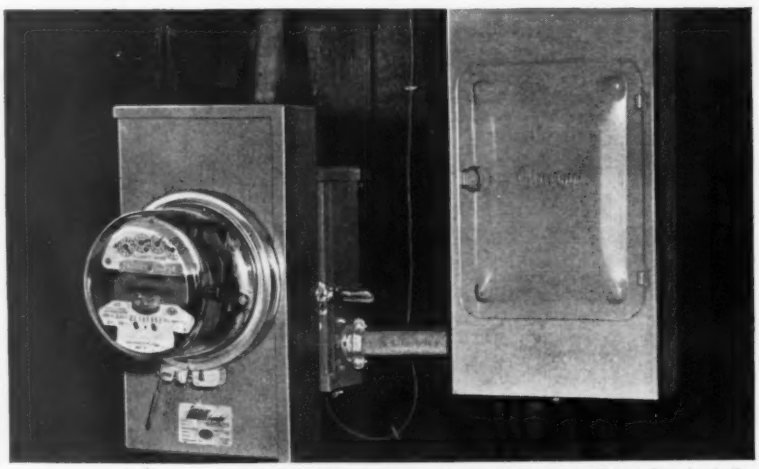
The Most Economical Secondary Capacitors to Install are Sangamo Secovars

Secovars—240 volt secondary capacitors—are easily installed right at the meter box to relieve the var load all down the line: from the service entrance to the secondaries, to the distribution transformer, to the power transformer, to the generator.

They cut installation costs . . . one-man installation realistically reduces the installed cost per kvar of Secovars in comparison to that of pole-type secondary capacitors. They conserve valuable pole space, too, and eliminate expensive engineering time.

Sangamo's exclusive Secovar Capacitors are available in three types to meet your requirements: Type OS (Original Socket) 2 kvar ratings; Type S, a 2 kvar rating for socket mountings; and Type N, a 1 or 3 kvar rating for nipple mountings. All types are fused, and some models can be furnished with a Klixon thermostatic switch if desired. All three feature weatherproof aluminum housings.

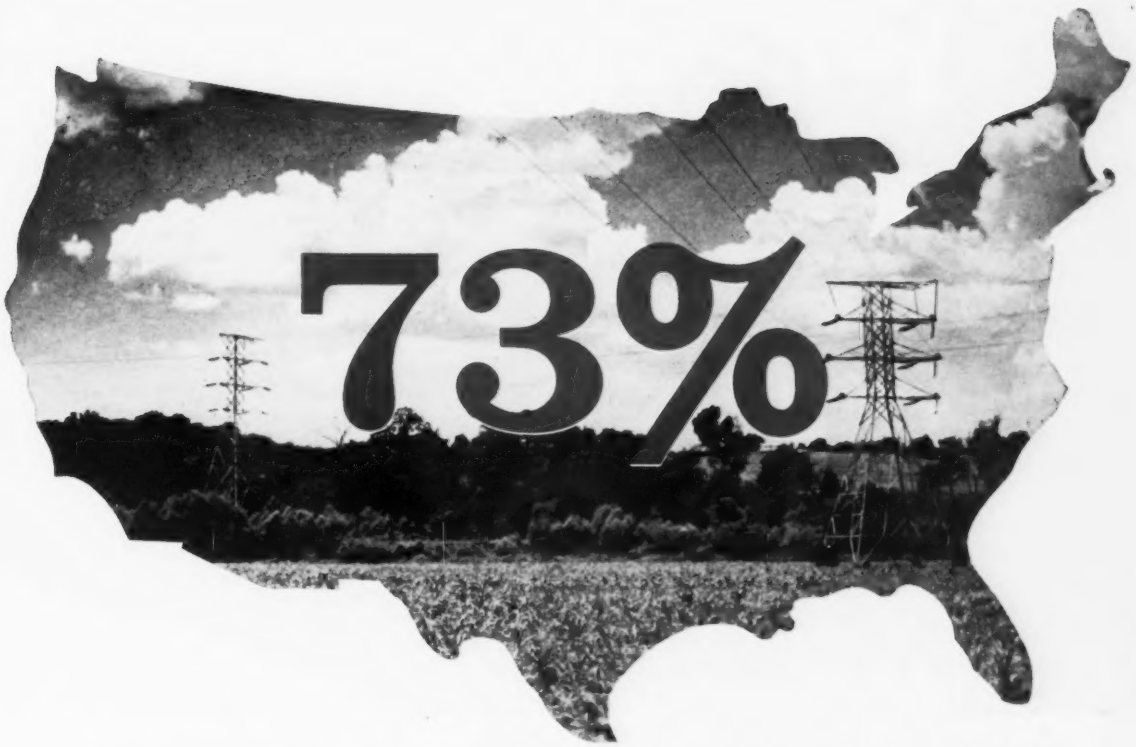
For the whole Secovar story, talk to your Sangamo Representative, or write for Bulletin 1132.



Typical meter socket Secovar Secondary Capacitor installation on the Rochester Gas & Electric Corporation system.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

PC60-1



Of The Nation's Foremost Electric Utilities Protect Equipment With SUBOX Paints

For over 35 years Subox paints have been of increasing service to America's electric utility companies. Today they provide dependable corrosion protection for many billions of dollars worth of transmission towers, substations and other equipment. No other paints in the land protect like Subox, because no others are made like Subox. Only Subox contains suboxide of lead, a unique pigment that continues chemically active even after drying. It builds a tough, fibrous coating that withstands the most punishing exposures.

Subox paints are dependable. And they are economical: one or two coats do the work of two or three of ordinary paint, and a Subox application endures for an average of 6 to 8 years.

May we discuss your corrosion problems with you?

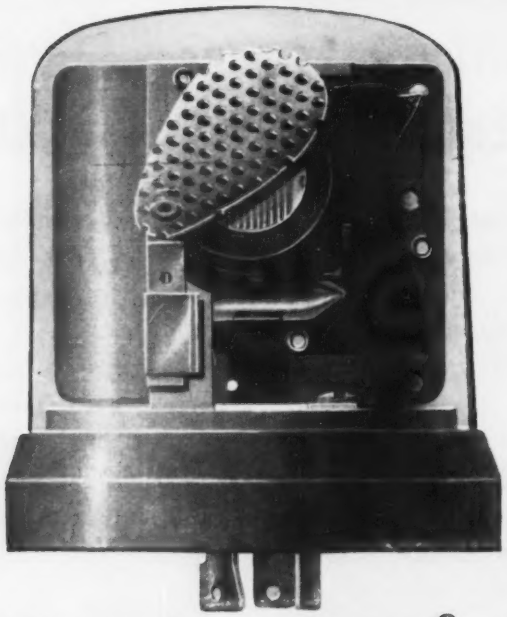
SUBOX PAINTS

Subox Inc.
Trade Mark

The Ambler Co., Denver, Colo.; Fred W. Carlson & Assoc., Butte, Mont., Seattle, Wash.; W. J. Cottrell & Assoc., Portland, Ore.; R. E. Cunningham & Son, Los Angeles, Cal.; Wrathall & Krusi, San Francisco, Cal.

Established 1924 Plant and office Hackensack, N. J.

FROM EVERY POINT OF VIEW



MARK I LUMATROL, *Tubeless*
(Actual Size)
NEMA MOUNTING

THE NEW MARK I **LUMATROL**® GUARANTEES HIGHEST RELIABILITY AT LOWEST COST IN AUTOMATIC STREET LIGHT CONTROL

Write for complete specifications

MICRO BALANCING, INC., HERRICKS ROAD, GARDEN CITY PARK, L.I., NEW YORK

In Canada: J. R. Kearney Corp., Box 270, Guelph, Ontario

ELECTRICAL CONTRACTORS TELL WHY...

THE BEST COSTS LESS INSTALLED

EASY MEASURE "INCH-MARKS"® make measuring a cinch, eliminate guesswork and save installation time.

FULL LENGTH "GUIDE-LINES"® help avoid costly "wows", speed installation, and eliminate wasted materials.

EXCLUSIVE "INSIDE-KNURLING" with new SILVERSLICK® finish makes wire-pulling up to 37% easier. Wire-pushing easier, too.

SILVERSLICK, new inside finish of Republic's ELECTRUNITE E.M.T., was introduced the first part of last year. A business reply card was attached to every tenth bundle. Here are but a few comments of the hundreds of replies as received by H. R. "Hank" Coward, Manager of Republic's Electrical Products Sales:

"We used your product in sizes ½" to 2" on a large project. With SILVERSLICK, wire-pulling is noticeably easier."

"Anyone interested in saving time and aggravation in his wire-pulling jobs should certainly use your SILVERSLICK."

"We have used your ELECTRUNITE for many years and have noticed a marked difference since you introduced SILVERSLICK. The "GUIDE-LINES" and "INCH-MARKS" are most helpful and ELECTRUNITE is easy to bend."

"SILVERSLICK is just what was needed to simplify wire-pulling."

"The five #12's we pulled in the ¾" ELECTRUNITE was without the use of easy pull. It's the best yet for E.M.T."

Many of the comments were short but to the point. Such as: "The best we have ever used." "Works fine." "The best out." "Makes wire-pulling easier." "It is considerably easier."

Try Republic ELECTRUNITE E.M.T. on your next job. Then, send us your comments. We think you will like the economies and advantages of ELECTRUNITE because... the *best* costs *less* installed!

REPUBLIC STEEL

STEEL AND TUBES DIVISION

Cleveland 8, Ohio

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • DEPT. C-9533-A
216 EAST 131st STREET • CLEVELAND 8, OHIO

I want to know more about the installation advantages of Republic ELECTRUNITE® Electrical Metallic Tubing.

Name_____ Title_____

Firm_____

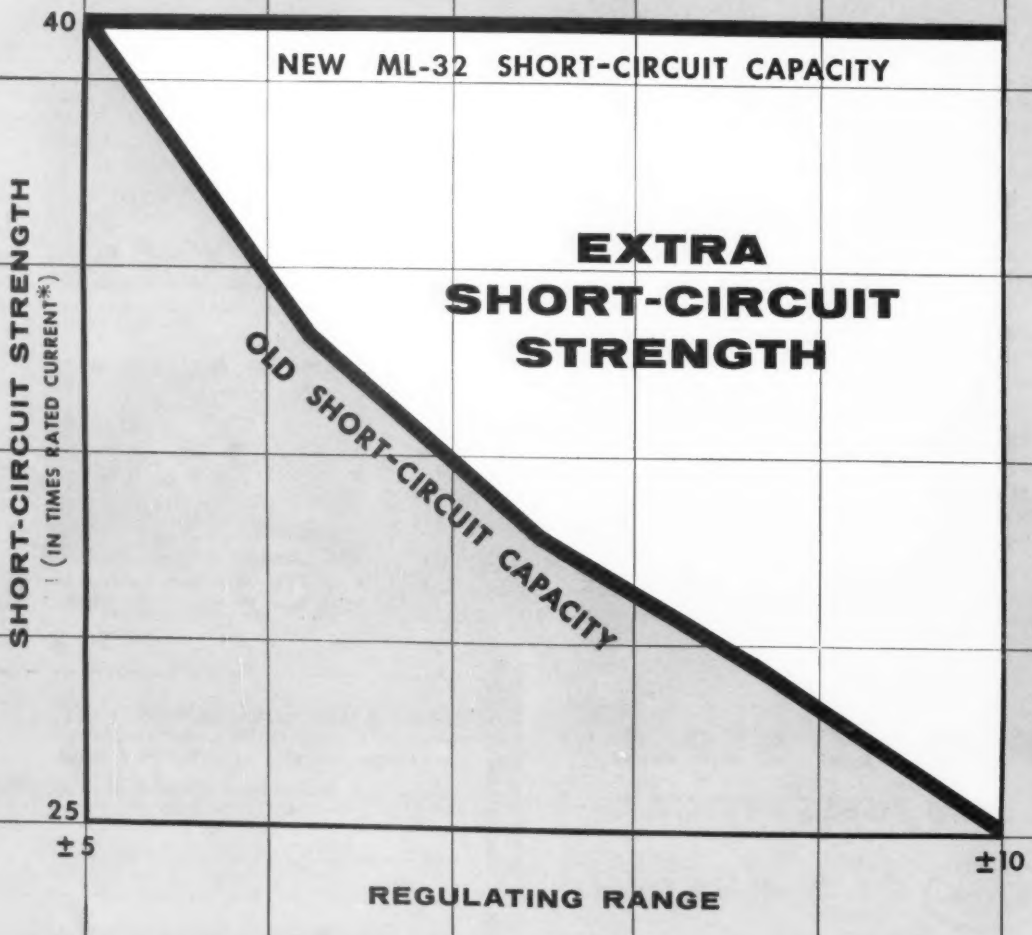
Address_____

City_____ Zone____ State_____

For phone number of closest representative see advertising index in back of book.

NOW STANDARD ON ALL GENERAL ELECTRIC

40 times rated current* short-



* *Rated current is the nameplate current at ±10% regulation.*

SINGLE-PHASE STEP VOLTAGE REGULATORS

circuit strength

New, stronger coil windings of General Electric single-phase ML-32 step voltage regulators will now withstand short-circuit currents of 40-times basic nameplate rating (the basic current rating at ±10% regulation) at all Load Bonus positions.

This increased short-circuit capacity is available for a duration of 0.8 seconds (48 cycles). With modern breakers, this time period gives ample leeway to detect a fault and de-energize the circuit.

Additional strength to resist high-current forces means increased protection against service outage under all current loads, plus even longer dependable life for already superior General Electric voltage regulators. Both of these important benefits are now available in G-E regulators at no increase in price.

These service extras are now possible because of the following G-E design improvements:

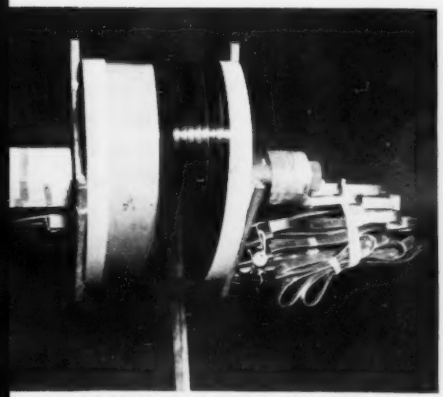
- **TIGHTER WINDINGS**—new coil winding process provides tighter, even coils; inherently stronger, better able to resist coil movement caused by short-circuit stresses.
- **SPECIAL INSULATION**—specially treated layer insulation forms a stronger winding-to-winding bond for finished coil. Additional protection added at points of most-severe stress to further resist coil shifting.
- **CONTROLLED DUCT SPACING**—cooling duct spacers are accurately positioned to hold windings firmly in place against radial forces during short circuits.
- **BALANCED WINDINGS**—coils are precisely aligned to resist destructive forces caused by short circuits.

This new high standard for voltage regulators is another dividend you receive from G-E research.

To learn more about all the reasons why G-E Voltage Regulators Cost Less on the Line, contact your nearby General Electric Apparatus Sales Office or Agent. Or write for Bulletin GED-3905, General Electric Company, Section 423-41, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC



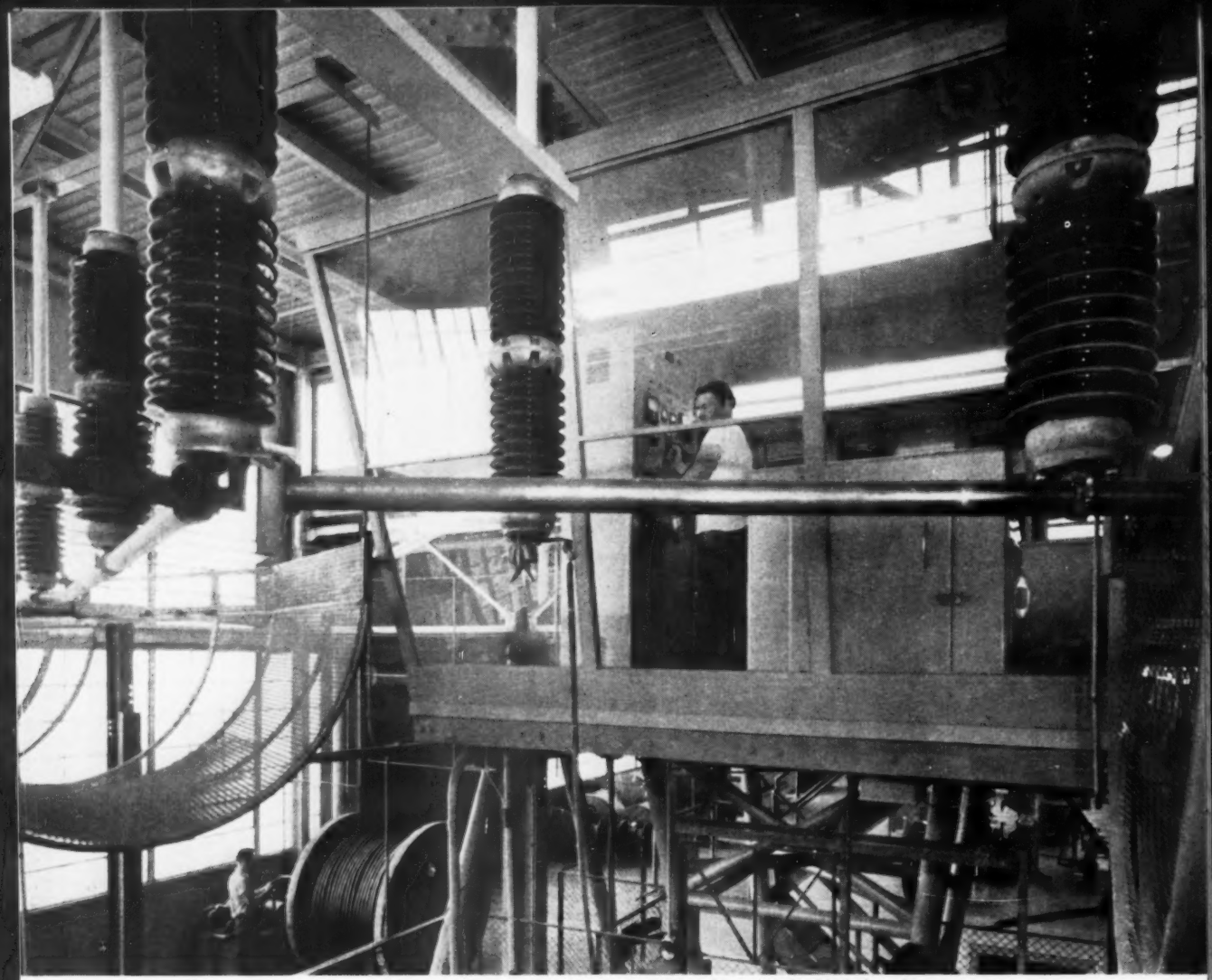
RUGGED COIL wound by new process provides stronger resistance to forces caused by high short-circuit current.

SPECIAL INSULATION strengthens coil by stronger winding-to-winding bond, resists movement caused by short-circuit currents.

EXTRA REGULATOR STRENGTH

(for a typical ML-32 100-ampere unit)

Regulating Range	Current Range	Former Short-circuit Capacity	NEW Short-circuit Capacity
±10%	100 amp (normal)	2500 amp	4000 amp
±8¾%	110 amp (load bonus)	2750 amp	4000 amp
±7½%	120 amp (load bonus)	3000 amp	4000 amp
±6¼%	135 amp (load bonus)	3375 amp	4000 amp
±5%	160 amp (load bonus)	4000 amp	4000 amp



Shown here is a section of final testing area. Voltage tests are being applied to *full reel lengths* of cable before shipment.

ANOTHER BIG REASON WHY YOU SHOULD CONSIDER ANACONDA BUTYL (AB) CABLE—

SPECIALIZED QUALITY CONTROL AND INSPECTION

From the start: Raw-material suppliers are required to submit certified test reports. Then, tests and sampling at our plant offer extra protection even before production begins. **To finish:** Here's the final inspection line where the finishing touches are applied and where every inch of cable is carefully inspected. Perhaps you already know that Anaconda test procedures are much above industry standards. But do you know that test voltages on Anaconda Butyl (AB) Cable are 125% of industry standards—that minimum corona level is 150% of rated voltage to ground?

Quality control at Anaconda is *more* than mere testing and inspection. It is built into every manufacturing step. That's why you can be sure your Anaconda cable will be of high quality—why you can be sure Anaconda Butyl (AB) Cable is the finest rubber-insulated cable you can buy.

Everything you need to know about Anaconda Butyl (AB) high-voltage cable is neatly summed up in a new booklet, DM-5903, "Anaconda High-Voltage Durasheath* Cable." For your copy, write to: Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y. *Reg. U.S. Pat. Off. 60294

ASK THE MAN FROM

ANACONDA®

ABOUT BUTYL (AB) HIGH-VOLTAGE CABLE

FASTEST WESTERN SERVICE—At Orange, California, Anaconda's expanded, modernized mill fabricates and stocks copper and aluminum wire and cable for every type of application. Anaconda assures the fastest possible service on all West Coast needs. See Anaconda Sales Offices: Los Angeles, San Francisco, Seattle, Denver.

Meetings Calendar

MAY

2-6—*Western Joint Computer Conference*, San Francisco.

3-5—*Illuminating Engineering Society*, South Pacific Regional Conference, Hollywood Roosevelt Hotel, Los Angeles.

9-10—*IES*, Pacific Northwest Regional Conference, Benjamin Franklin Hotel, Seattle.

9-12—*National Electrical Contractors Assn.*, District 5, and IBEW, District 7, joint meeting, Westward Ho Hotel, Phoenix.

9-12—*NECA*, Tri-District (Districts 6, 8, 9) regional conference, Olympic Hotel, Seattle.

16-18—*Pacific Coast Electrical Assn.*, annual convention, Stardust Hotel, Las Vegas.

17-21—*Appliance Parts Jobbers Assn.*, annual convention, Dunes Hotel, Las Vegas, Nev.

19-20—*Northwest Public Power Assn.*, Engineering & Operations Section, annual meeting, Elks Lodge, Port Angeles, Wash.

23-25—*Northwest Electric Light & Power Assn.*, Business Development Section, Chinook Hotel, Yakima.

24-26—*Institute of Radio Engineers*, seventh regional conference, Olympic Hotel, Seattle.

JUNE

15-17—*Northwest Electric Light & Power Assn.*, Accounting & Business Practice Section, Hotel Benson, Portland.

15-17—*National Conference of Utility Radio*, Continental-Denver Motel, Denver.

16-17—*Oregon Rural Electric Cooperative Assn.*, annual meeting, Gearhart Hotel, Gearhart, Ore.

JULY

17-22—*Los Angeles Summer Market.*

21-22—*Edison Electric Institute-Rocky Mountain Electrical League*, Joint Industrial Relations Committee, Hilton Hotel, Denver.

24-29—*San Francisco Summer Market*, Merchandise Mart.

AUGUST

8-12—*American Institute of Electrical Engineers*, Pacific general meeting, El Cortez Hotel, San Diego.

23-26—*Western Electronic Show & Convention*, Memorial Sports Area, Los Angeles.

SEPTEMBER

7-9—*Northwest Electric Light & Power Assn.*, 53rd annual meeting, Glacier Park Lodge, Mont.

7-10—*Rocky Mountain Electrical League*, annual meeting, Denver Hilton, Denver, Colo.

12-14—*International Association of Electrical Inspectors*, Northwestern Section, Sheraton-Portland Hotel, Portland.

RESISTS CORROSION

This new super line of "Chem Marine" devices are engineered from corrosion resistant materials capable of withstanding the harmful effects of moisture, brine, grease, oils and many acids. They are designed for industrial applications such as plating rooms, shipping platforms, yards, shops, warehouses, or wherever corrosion or chemical action is a problem.

Special Materials:

"INSULPRENE"—a Du Pont neoprene compound.

"MONEL® METAL"—Reg. Trademark of INCO.

"MELAMINE"

"CYMEL®"—Reg. Trademark of Am. Cyanamid

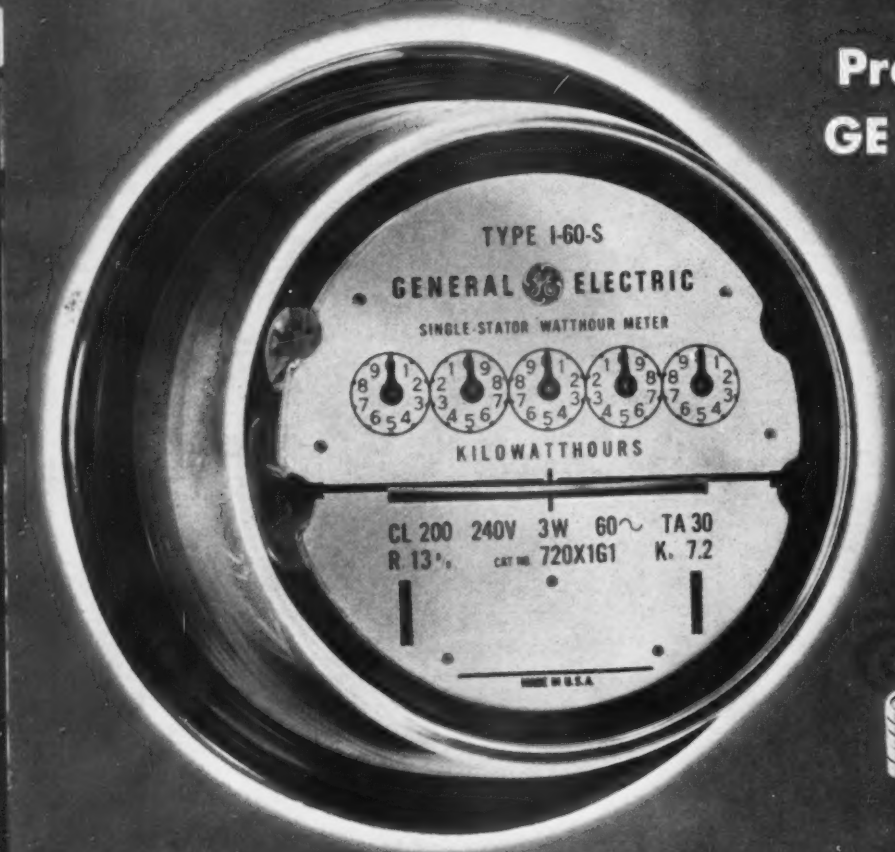
HEAVY NICKEL-PLATED CURRENT CARRYING PARTS.

52CM62
3-wire, 15 amp., 125 volt "Melamine" Duplex Grounding Receptacle
74CM20
Metal Weatherproof Lift Cover Plate with heavy vinyl coating for single receptacles. Shown with 73CM10 "Twist-Lock" Receptacle and mounted to standard FS box.
99CM60
Shown with "Insulprene" "Seal-Tite" Cover 75CM31
52CM11
Weatherproof Lift Cover Plate for duplex receptacles used with FS boxes.
17CM51
Weatherproof "Insulprene" Plate and A.C. "Pressswitch" Combination.
Listed by: Underwriters' Laboratories, Inc.
99CM66
3-wire, 20 amp. "Insulprene" "Twist-Lock" Connector Body

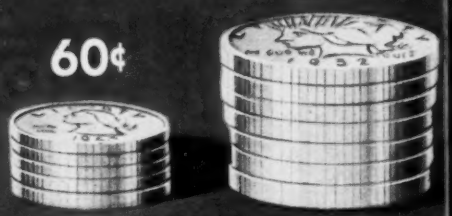
"Chem Marine" devices are identified by their bright yellow color and a few representative items are illustrated above. For complete information contact the "Chem Marine" Department.—

HARVEY HUBBELL, INCORPORATED

BRIDGEPORT 2, CONNECTICUT, In Canada: Scarborough, Ontario



Present Worth of GE I-60 Magnetic Purchased



Today's purchase of each General Electric I-60 meter provides . . .

Up to $9.13 in EXTRA VALUE because

Each General Electric single-phase meter with magnetic suspension put in service today can save you up to $9.13 in present worth, $27.19 in gross revenue loss over 30 years . . . here's proof:

Assume an average kw-hr usage per consumer based on extrapolations of Electrical World forecasts per year for 30 years and the percent loss of registration for each of the 30 years (see graph at right for magnetic suspension vs. ball-bearing meters). Result: total loss for each ball-bearing meter would be 1141.3 kw-hrs *more* than for G-E's magnetic suspension meter. With an average cost of $.02382 per kw-hr in revenue loss, this means a gross total revenue loss of $27.19. At six percent annual interest, the "present worth" of the extra value (resulting from greater sustained accuracy) on every magnetic suspension I-60 meter purchased today is up to $9.13 . . . vital proof that, in metering, it pays to buy the BEST.

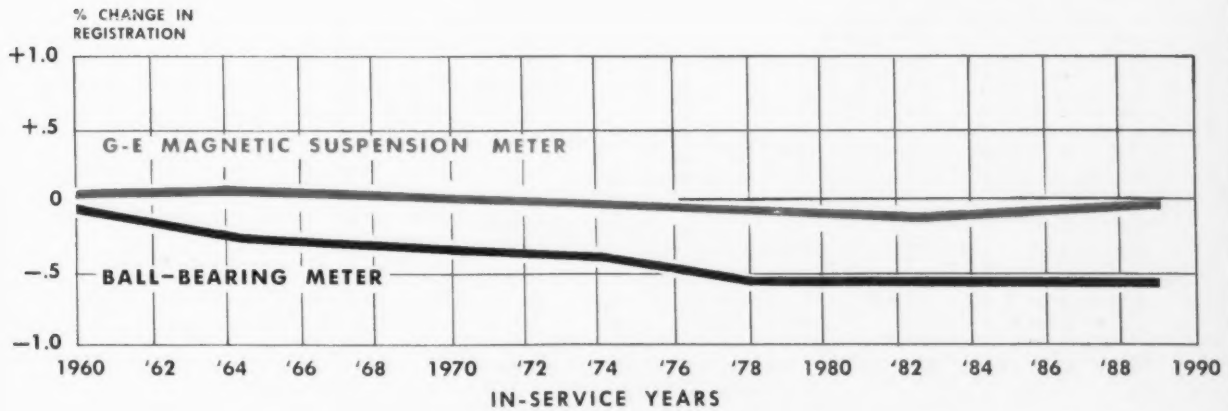
Like more information? Contact your General Electric Apparatus Salesman. Or, write General Electric Co., Somersworth, New Hampshire. 713-01

SERVING MEDALLION HOMES EQUIPPED BY GENERAL ELECTRIC

MEDALLION HOME — LIVE BETTER ELECTRICALLY

In metering, anything less than the best is too costly.

# of Greater Sustained Accuracy



METER DEPARTMENT

GENERAL ELECTRIC

LETTERS TO THE EDITOR

Hughes Would Be Shocked

To the Editor:

You may be interested to learn how far from home your magazine is being read. I have been a regular reader of our university subscription, which is primarily intended for and kept in the Technical Reference Room of our School of Engineering. For the past seven years I have been the chairman of the Committee on Technical Literature for the TRR.

Although interested in practically all phases of the electrical field, this letter was inspired by the series of articles, during the past year, on motors and their control by Tom Hughes. If Mr. Hughes thinks that conditions in the U.S.A., in regards to motor applications, are bad he should come to the Middle East! He would be treated to a "shock" that would really disturb him.

In the first place there is no semblance of a code of any kind to regulate the selection and installation of electrical equipment and wiring systems, and "tradition" alone —of the vintage of the early 1920s—is the guiding set of rules. Imagine the complexities involved in trying to superimpose the modern kind of equipment—from a dozen different countries—upon a skeleton of such archaic vintage!

Ever since its inauguration in 1951, the American University of Beirut School of Engineering has been trying, both by precept and practice, to improve the local habits, and by sending out our graduates as missionaries, all over the Middle East, to do likewise.

For the past two years I have been devoting a considerable portion of my waking hours to the compilation of codes for plumbing, heating, ventilating, air conditioning and electrical work, and am presently completing the latter.

Unfortunately, in addition to being extremely backward in their techniques in all of the mechanical and electrical trades, the governing principle of doing business has been dominated by the vicious practice of: (a) the lowest first cost and (b) keen competition created by European exporters in cooperation with the local distributors, whose code of business ethics and ignorance of technical knowledge combined has established a very difficult and antagonistic attitude toward raising the local standards.

The large companies, like Aramco in Saudi Arabia and the Iraq Petroleum and Shell companies in the several M.E. countries, have avoided the problem by importing, either from the U.S.A. or the U.K., all materials directly, and by training their own technicians for the various trades.

Even though it has been frustrating and discouraging at times, we are beginning to see some encouraging signs of improvement as our students (who, in the M.E., rise rapidly to positions of responsibility) become more and more active in the application of their engineering training at the AUB.

I am happy to see my old friend George Taylor (the '49er, June 1959, p 91) of the IES getting so much publicity. My association with George goes back more than 20 years to when he was at Nela Park and I was with the Austin Co. in Cleveland. My own career in the field of mechanical and electrical engineering started at Muscle Shoals, Ala., in 1919 as a field engineer with the J. G. White Engineering Corp. under its late president, Ford Kurtz. This experience was followed by two years at Shawinigan Falls, Canada, five years with the Cleveland Electric Illuminating Co. and more than 20 years with the Austin Co. The latter three years with Austin I spent at the Argonne Labs in Chicago, the Arco Testing Grounds, Idaho Falls, and on the Rocky Flats Atomic Energy plant near Denver. I left Denver in 1951 to join the faculty of the AUB.

I am being retired at the end of the current academic year, and we will return to the U.S.A. on a freighter via the Far East, arriving in San Francisco about Oct. 1. We plan to visit friends on the West Coast before returning east.

All this inspired by Tom Hughes' article!

WALTER BAGGALEY*

**Senior Professor of Mechanical Engineering, Consulting Mechanical & Electrical Engineer to the Department of Buildings Engineer to the Department of Buildings and Grounds, American University of Beirut, Lebanon.*

Electrifying Sixties

To the Editor:

At the beginning of each new decade there ensues the search for a catchy and attention-getting popular name for the period ahead.

In the period just ended, probably the name that will be most enduring will be "The Fabulous Fifties." The words were alliterative and the period was filled with advances in so many directions, scientific and otherwise, as to be almost "incredible or beyond sober reality."

Various names for the present decade are now being used. One example is "The Golden Sixties." Perhaps that is supposed to denote that we are all going to get rich and that's kind of a nice feeling too. I doubt that it was intended as being descriptive of a period comparable to the golden age of arts and literature of classic Greece.

I notice that EEI is using "Electricity Sparks the '60's" as the theme for National Electrical Week. That really wasn't intended as a name for a period. Instead it expresses the hope of us in the industry that electricity will provide the source of power for these years. And in a way, it is slightly negative. Electricity Sparks the '60's is just a wee mite comparable to having AGA adopt as its slogan "The Explosive Sixties."

I believe there is a descriptive name for this period that would be helpful to our industry—one that holds some possibilities for being used broadly even by people outside of our industry. It would be especially valuable if editorial writers generally were to gravitate toward that name—and properly handled—this is not beyond the bounds of possibility. Wouldn't it be wonderful if the American public became sold on the idea that we are now in the period of The Electrifying Sixties?

Ralph Z. Sorenson, Manager
Utility Sales Department
Westinghouse Electric Corp.
Mansfield, Ohio

Here are the Graybar Offices in the West

ARIZONA

Phoenix:	1700 North 22nd Ave ALpine 2-2371
Tucson:	212 South Park Ave. MAin 2-6439

CALIFORNIA

Bakersfield:	2828 "K" St. FAirview 4-4755
Fresno:	2626 Hamilton Ave. ADams 7-4175
Long Beach:	800 West 16th St. HEmlock 2-2911
Los Angeles:	210 Anderson St. ANgelus 3-7282
Oakland:	1911 Union St. GLencourt 1-5451
Oceanside:	805 N. Tremont St. SAratoga 2-2141
Sacramento:	1900 - 14th St. HIckory 4-8830
San Bernardino:	655 South "H" St. TUrner 9-1051
San Diego:	720 State St. BElmont 3-1361
San Jose:	1376 N. Tenth St. CYpress 2-9090
San Francisco:	1750 Alemede St. MArket 1-5131
Santa Ana:	301 French St. KImberly 3-8309
Santa Barbara:	329 S. Salinas St. WOodland 5-1013
Van Nuys:	15520 Cabrito Road STate 2-9600

COLORADO

Colorado Springs:	630 West Vermijo Ave MElrose 4-3701
Denver:	104 Wazee Market TAbor 5-7111

IDAHO

Boise:	1325 Idaho St. BOise 3-2594

MONTANA

Butte:	604 E. Aluminum St. BUtte 3233

OREGON

Eugene:	2380 West Broadway Diamond 4-2224
Portland:	N.E. 60th and Banfield ATlantic 8-5661

UTAH

Salt Lake City:	336 North Third West St ELgin 9-8771

WASHINGTON

Seattle:	King & Occidental Sts. MUtual 2-0123
Spokane:	West 1033 Gardner Ave. FAirfax 7-6611
Tacoma:	2112 "A" St. MArket 7-0164

FOR IMMEDIATE SERVICE ON EVERYTHING ELECTRICAL CALL THE OFFICE NEAREST YOU

You can save money on line construction with Graybar as your auxiliary warehouse

Use Graybar as your auxiliary warehouse for line construction materials and you make substantial savings of both time and money – in planning, ordering, checking. Save on inventory and transportation costs.

This is because Graybar stocks just about everything needed for line construction, "from the top of the pole – to the bottom of the hole" – and can deliver it all promptly to your central warehouse, substores or work centers.

Another important source of savings – the wide variety of construction tools available from Graybar that help speed the job.

Start with a local call . . . Have your local Graybar man stop in for a discussion.

Employee-owned Graybar has been on the line and part of the local scene for years. Whether you require 3 items or 3,000, Graybar is your centralized source for most electrical utility equipment and supplies.

When Graybar is your auxiliary warehouse —

- You save on storeroom costs
- Reduce inventory investment
- Insure prompt delivery
- Step up manhour efficiency
- Simplify bookkeeping

943

GraybaR

ELECTRIC COMPANY, INC.

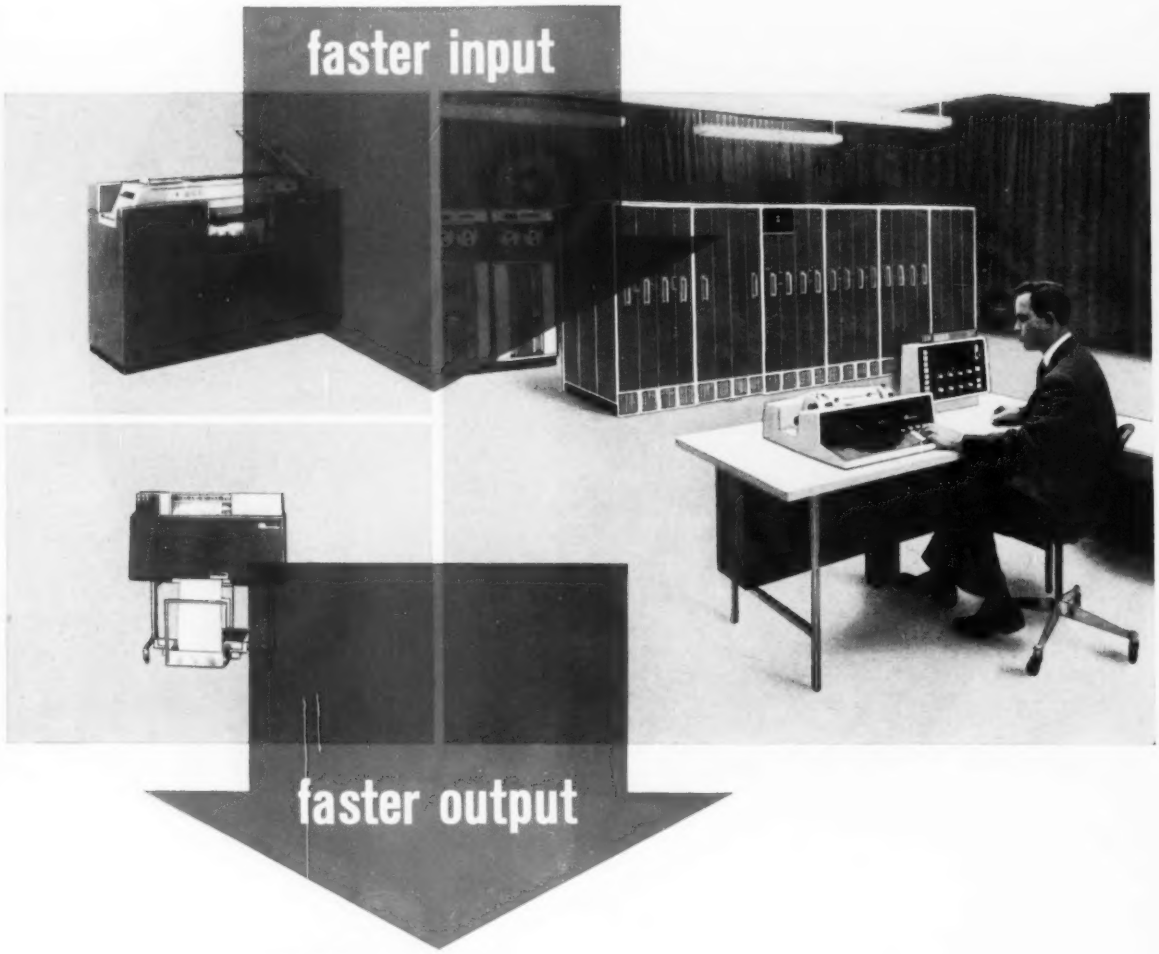
420 Lexington Avenue, New York 17, N. Y.

Everything Electrical GraybaR ELECTRIC COMPANY

IN OVER 130 PRINCIPAL CITIES

LOCAL SERVICE TO UTILITIES THROUGH COAST-TO-COAST WAREHOUSING

with IBM's new, high-speed 1401 System for



... the powerful IBM 7070 now packs even greater processing power

Greater flexibility in putting your problem on computer . . . greater speed in taking results off . . . greater flexibility in handling peripheral operations—these are the features that IBM's exciting new 1401 System brings to the IBM 7070. The 1401 balances input/output speeds to match the tremendous processing speed of the 7070, adds powerful off-line editing and programming facilities to free the computer for more profitable work. The total system—designated the tape-oriented IBM 7070—gives you lower job cost . . . more production per dollar.

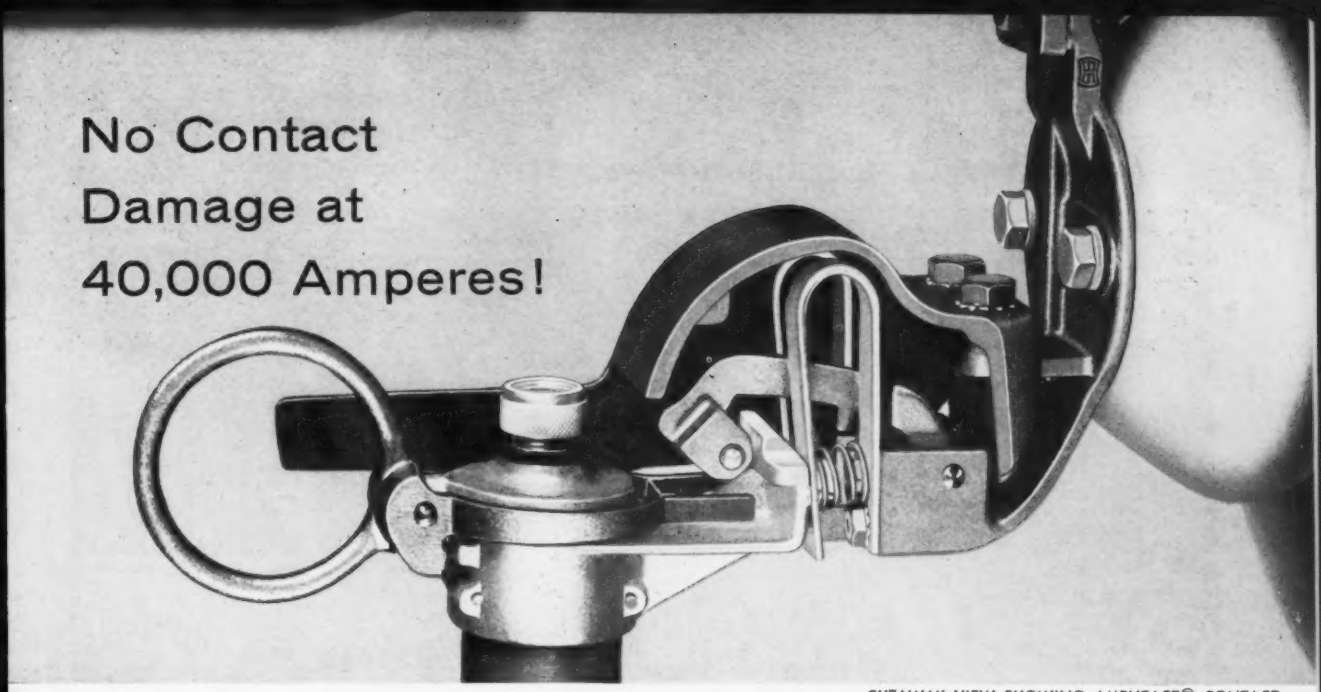
The tape-oriented 7070 employs the 1401 System to boost card-to-tape conversion from 500 to 800 cards a minute. The 1401 also features an exclusive horizontal chain printer that turns out crisp, perfectly aligned copy at 600 lines a minute. This unique printer moves paper at magnetic tape speeds—up to three and a half times faster than conventional printers!

With these advances comes unusual flexibility. The tape-oriented IBM 7070 is a solid state, high-capacity system. It can be expanded from a single-channel 4-tape to a four-channel 40-tape system. It can read on one to four channels simultaneously with computing. And in keeping with IBM's concept of Balanced Data Processing, the 7070 is linked with comprehensive services ranging from personnel education and program planning through reliable service engineering.

For full information on the new tape-oriented 7070 call your IBM representative. Like all IBM equipment, the 7070 System may be either purchased or leased.

IBM®

BALANCED DATA PROCESSING



CUTAWAY VIEW SHOWING AMPLITACT® CONTACT

SOUTHERN STATES' POWER FUSES EMPLOY AMPLITACT® CONTACTS TO PREVENT CONTACT DAMAGE

Now, for the first time, "switch-proved" Amplitact® contacts are used on Southern States power fuses. Repeated tests at current ratings up to 40,000 amperes show no contact damage.

Used successfully for many years on Southern States air switches, Amplitact® contacts are now used on the new BPA and HPA Power Fuses.

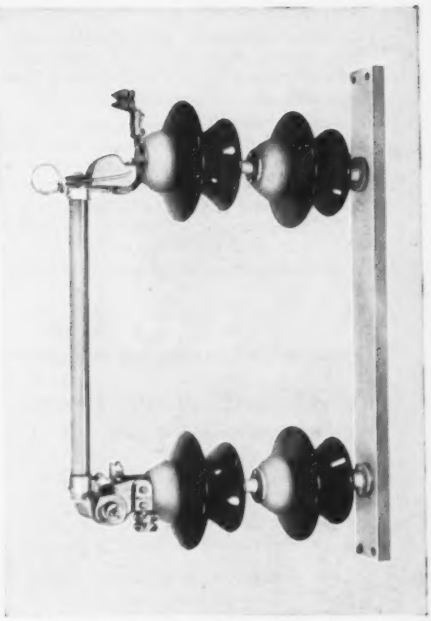
The Amplitact® harnesses electromagnetic forces generated on a high fault, increasing contact pressure when it is needed most.

While contact damage under extremely high fault currents has been more irksome than serious, the Amplitact® eliminates any possibility of damage.

These new power fuses have all of the outstanding advancements of the BP, MP, and HP power fuses introduced by Southern States in 1959—plus the reverse-loop contact. They have expendable cap fuse holders to provide dependable clearance of high or low current faults. Fuse holders are designed for easier handling and are equipped with a large operating eye. A stationary sleet shield gives better protection against icing and provides guidance when the fuse is slammed closed.

Low cost refusing in the field is accomplished with easy-to-use fuse kits.

Get your Southern States representative to give you full information about this important development in power fuses, or write direct for Bulletin 60 PF.



TYPE HPA POWER FUSE

KEEP PACE WITH ELECTRICITY

IN CANADA
Dominion Cutout Co., Ltd., Toronto

SS

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

In the heart of Lake Charles . . .

Photo by Rybiski, Lake Charles, Louisiana

Lake Charles, Louisiana . . . city on the move. Industrial hub of the Gulf Coast. Major port and center of Louisiana's petroleum industry. Big producer of chemicals. Home of the world's largest rice mill. Good home, too, to 70,000 people.

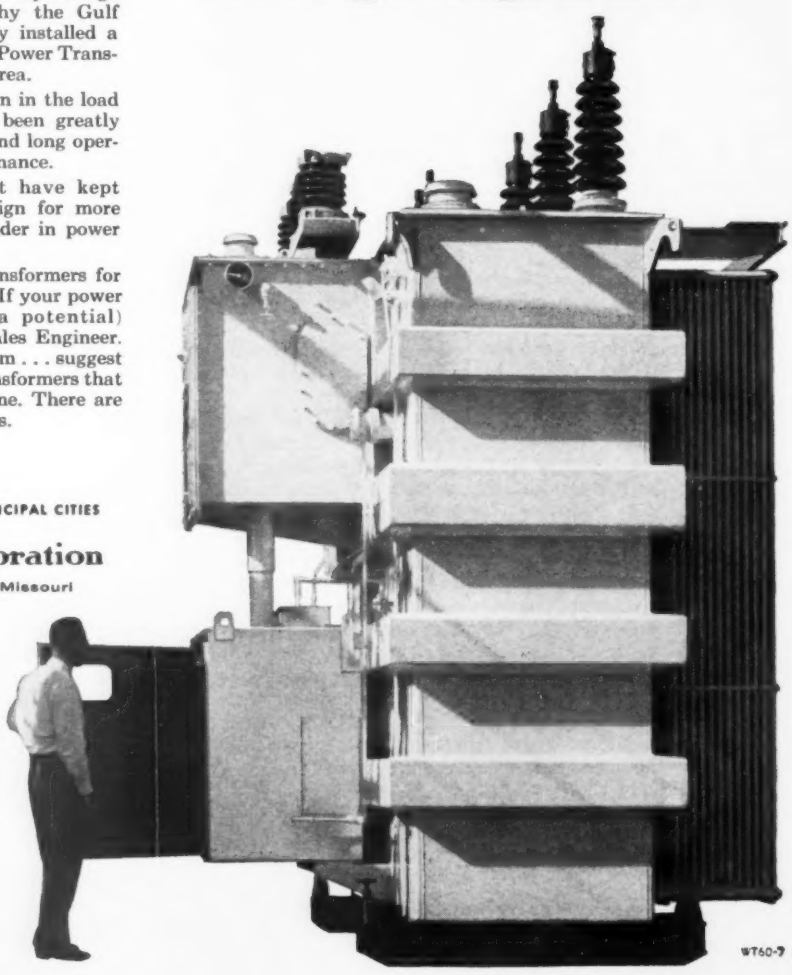
In Lake Charles, the demand for power grows—steadily, in the long run, but with daily and seasonal demands varying from light to heavy. These fluctuating demands emphasize the importance of automatic voltage regulation to maintain steady voltage under all load conditions. That's why the Gulf States Utilities Company has recently installed a 7500 Kva Wagner Load Tap Changing Power Transformer in the downtown commercial area.

This compact unit utilizes a new design in the load tap changing mechanism, which has been greatly simplified to provide quiet operation and long operating life with extremely little maintenance.

Constant research and development have kept Wagner up front in transformer design for more than 65 years . . . made Wagner a leader in power planning. So, remember this:

Wagner makes a complete line of transformers for industrial and power company needs. If your power needs present a critical (or even a potential) problem, call your nearby Wagner Sales Engineer. He'll help you plan your power program . . . suggest Wagner power and unit substation transformers that will meet your needs for years to come. There are Wagner branches in 32 principal cities.

This Wagner LTC TRANSFORMER Assures Automatic Voltage Regulation



Wagner magnetic amplifier control equipment senses any voltage fluctuation in the line and automatically regulates the voltage to meet the demand.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6381 Plymouth Ave., St. Louis 33, Missouri

LIVE BETTER ELECTRICALLY

WT60-7

ELECTRICAL WEST SPOKESMAN FOR MOST HIGHLY ELECTRIFIED REGION OF THE U. S. VOL. 124, NO. 5 MAY 1960

ASPEN LAKE with Upper Klamath Lake to the east. Arrow shows area in which Copco's pumped storage facilities will be located

To conserve water for future irrigation and power development

COPCO PLANS PUMPED STORAGE

JOHN BOYLE, CALIFORNIA OREGON POWER CO.

John Boyle's professional career has been devoted to the development of hydro resources of the Northwest. Fifty years ago this month, he joined the Siskiyou Electric Power & Light Co. (a predecessor company) as assistant engineer in charge of field surveys at what is today Copco No. 1 site. In the meantime, he has planned, designed and directed the construction of what is today the California Oregon Power Co. Today he is director, vice president, general manager and chief engineer of Copco. Some title? Yes, but then, John Boyle is some guy.—The Editor.

The California Oregon Power Co. has been associated with the water resources development of the Upper Klamath Basin for the past 50 years. At the beginning of the period, large lakes (Lower Klamath Lake and Tule Lake) were natural reservoirs which, together with the Upper Klamath Lake, had the effect of natural flood control and regulation of stream flows in the Klamath River.

As the reclamation of these lakes progressed, the water which naturally covered the lake bottoms was diverted to the Klamath River, changing the natural processes and creating greater river discharges during the high-water period, with resulting smaller discharges during the low-water periods.

Furthermore, as irrigation of lands progressed, diversions for irrigation utilized more of the water during low-water periods, thereby further reducing natural minimum flows to the Klamath River.

Copco and the Bureau of Reclamation have realized that this process should be reversed and water conserved in some manner to insure an adequate continuous supply for further irrigation development and to protect existing as well as future power developments.

The first step in this program of conservation was the execution of a contract in 1917 between Copco and the Bureau for the regulation of Upper Klamath Lake of 6.3 ft. This regulation assured adequate water supply for the irrigation lands and carried over into the low-water pe-

riods the water needed for power purposes.

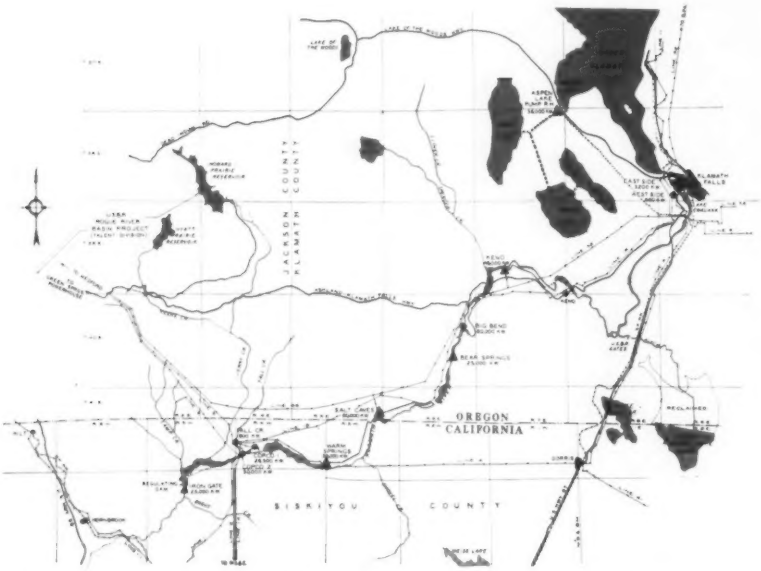
After 30 years of regulation of Upper Klamath Lake, it became apparent that the present usable storage capacity of the Upper Klamath Lake was not sufficient for ultimate development of both irrigation and power.

In June 1954 the Bureau of Reclamation issued its comprehensive report on the development of water and related resources in the Upper Klamath River basin. They concluded, "with complete irrigation development of all areas above and dependent upon the lake, both existing and future developments of Klamath River hydroelectric potential between Keno and Copco Lake would be dependent upon the maximum additional storage economically obtainable."

In pursuit of additional economic storage Copco and the Bureau have investigated five sites that could be used for supplemental storage.

When Copco proposed that pump storage be added in the Aspen Lake area, all those interested in these studies seemed satisfied that an answer had been found to the complete conservation of the Upper Klamath Lake water supply.

Properly conserved and regulated, the waters of the Klamath will be sufficient for domestic, industrial, irrigation power and wild life requirements for many years to come.



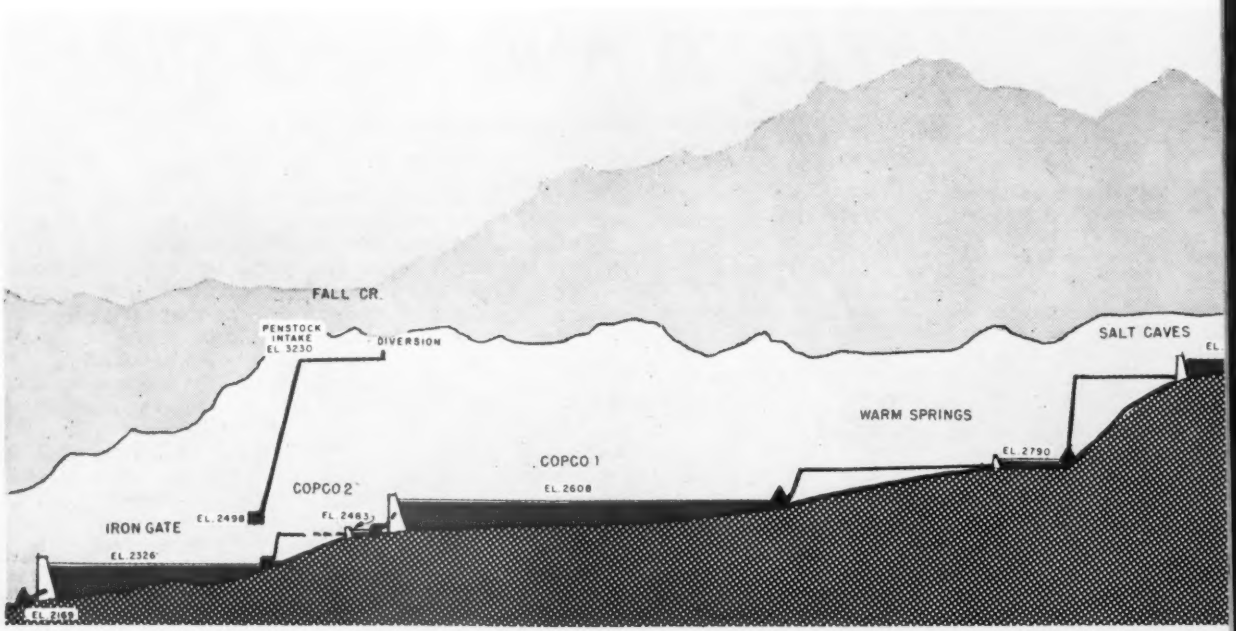
COPCO'S KLAMATH BASIN PROJECTS. Aspen Lake with Long Lake and Round Lake to the southeast are the storage reservoirs. (See legend in profile below)

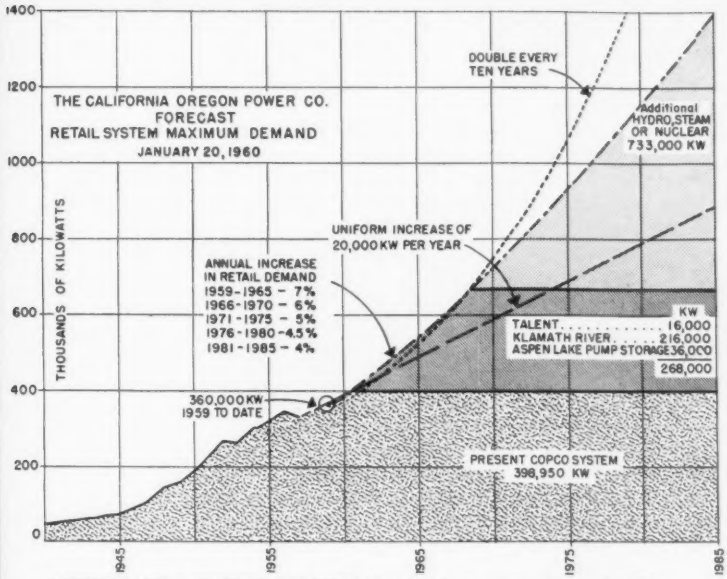
Pumped Storage

Pumped storage is a method of conversion of offpeak, or dump energy of low value, into firm or peak energy of high value. During offpeak hours, water is pumped from a lower reservoir to an upper reservoir, and is later used in reverse direction. The Aspen Lake pumped storage scheme combines the use of offpeak electrical energy with offpeak or dump water so that the development truly serves both water and power interests.

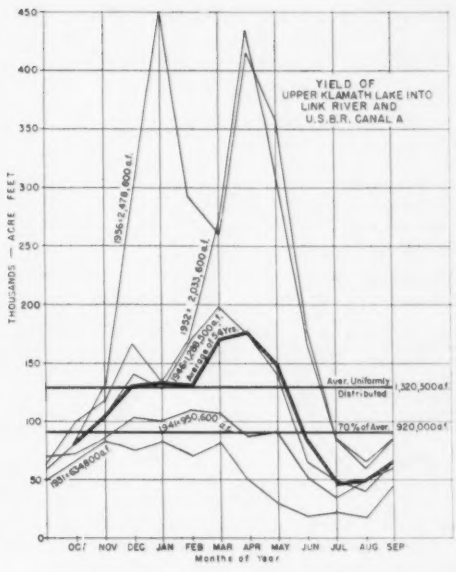
The use of pumped storage is not new. Such developments were used in Europe in 1882. Most of these developments were high head with separate turbines and pumps and were used for short durations, many on a daily basis.

In 1928 Connecticut Light &





ANTICIPATED SYSTEM DEMAND showing how pump storage facilities will augment power supply


YIELD OF UPPER KLAMATH LAKE INTO LINK RIVER AND U.S.B.R. CANAL A
THOUSANDS — ACRE FEET
1936-3,478,600 a.f.
1952-2,033,600 a.f.
1941-1,288,000 a.f.
Average 54 Yrs.
1934-950,600 a.f.
1931-634,000 a.f.
Aver. Uniformly Distributed 1,320,500 a.f.
70% of Aver. 920,000 a.f.
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
Months of Year

YIELD CHART shows heavy periodic surplus flows from Klamath River

Power constructed a plant using 230-ft head for daily and seasonal peaks with separate pumps and turbines.

Recently, the development of a reversible pump turbine reduced machinery costs and made more attractive the use of pumped storage. The first sizable unit was built by the Bureau of Reclamation on the Big Thompson project in Colorado, then in 1957 the Hiwassee project, a TVA development, and now the Niagara Falls installation in New York and Ontario is being completed. Many others are under study.

The storage and scheduling of the use of water in the Upper Klamath Basin for power purposes where irrigation uses are involved is a complicated problem. Studies have been based on 50 years of accurate water records. Considerable time and money have been spent on field surveys and engineering studies to determine the greatest economic value of the proposed pumped storage to the company in the Aspen Lake area.

Pumped Storage Development

1. In using the Upper Klamath Lake storage, together with other proposed storage reservoirs in the Upper Klamath Basin, contractual arrangement provides that the water

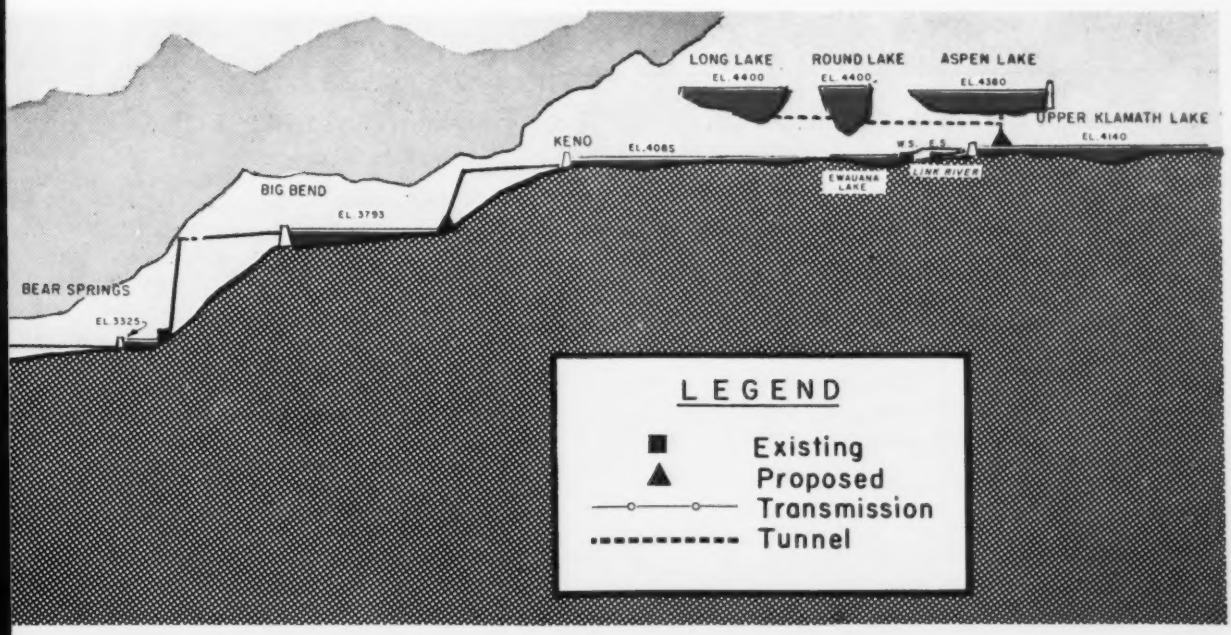


TABLE I—AVERAGE WATER DISTRIBUTION KLAMATH RIVER

	Acre-Ft
Average yield of Upper Klamath Lake at Link River	1,302,300
Maximum diversions to Canal A	266,000
Average available at Keno from Upper Klamath Lake	1,036,300
Average return flows at Keno	91,000
Total	1,127,300
Using 70% as basis of hydroelectric design	920,000
Average surplus yield at Keno	207,300

On this basis the 70% is conservative.

is first subject to irrigation diversions.

2. The use for irrigation purposes with priority over the use for power purposes is contingent upon returning all drainage flows to the Klamath River at Keno. Proper use of irrigation water and proper drainage to return flow may not materially increase the consumptive use. It is estimated that it will be 75 years before the amount of irrigated land will be double.

3. There is a further agreement that should supplemental storage be developed in the Upper Klamath River Basin, the water would be returned to that basin above Keno.

4. System operation of the company for the foreseeable future will follow the present pattern, namely, that the company's streamflow (Rogue River) plants will operate on base load, its North Umpqua plants will operate as peaking plants and the Klamath River plants will operate on system load factor.

5. In selecting a project that would provide sufficient storage of water and operate most efficiently on the company's system load curve, the cost must necessarily compare favorably with generation by steam.

Available Water Supply

Water available for power purposes below Keno comes from three sources:

1. Upper Klamath Lake and tributaries
2. Lost River and tributaries
3. Return flows from irrigated lands

All of which is made available to the Klamath River at Keno.

The outflow of the upper Klamath Lake at the upper end of Link River supplies Link River and the USBR main Canal A.

The average yield of Upper Klamath Lake (see chart) for the 54 years of record (1904 to 1958) is 1,320,400 acre-ft. The chart also shows high and low yield years. With this wide variation in available water, two points become clear.

1. During high yield years (1952-1956), available water for storage greatly exceeds the storage volume of Upper Klamath Lake (480,000 acre-ft).

2. Conversely, the limited storage of Upper Klamath forces a utility to derate the planned production of the electrical system because the storage cannot sustain production based on average yield.

The basis of design on the existing plants of Copco, including Big Bend, has been on a yield of 70% of the average of the years of record. Seventy per cent of 1,320,400 acre-ft is 920,000 acre-ft. Table 1 summarizes average river flows. The average surplus flow indicates that the 70% design figure is conservative. If this surplus could be stored, it would be possible to base production on 1,320,400 acre-ft.

There have been 16 years (1924 to 1939, inclusive) in the 54 years of record which represent the dry cycle. The average of these 16 years, including 1931, is 945,000 acre-ft. The extreme dry year 1931 shows a yield of 634,000 acre-ft and a deficiency of 286,000 acre-ft.

Table 2 shows how the Copco system would perform during the 1929-35 dry cycle with the power requirements forecast for 1968. The conclusion to be drawn from this chart is that 1,230,000-acre-ft storage on the Klamath would allow the system to serve its customers under the worst water conditions ever recorded.

Under 1968 system load requirements, the ultimate Klamath River development, with a planned aggregate capacity of 332 mw, would have

TABLE 2 — UPPER KLAMATH RIVER DEVELOPMENT (332 MW)

ENERGY AND STORAGE REQUIREMENTS FOR DROUGHT PERIOD 1929-35

1968 LOAD CONDITIONS

Year	Retail System Energy Requirement Mwh	Available Hydro Exclusive of Klamath River Mwh	Required From Klamath River Mwh	Available From Klamath River Mwh	Deficiency in Klamath River Mwh	Deficiency in Klamath River Acre-Feet	Supplied by Carry-over In Upper Klamath Lake Acre-Feet	Additional Storage Required Acre-Feet
1928-29	2,411,534	1,192,700	1,218,834	886,900	331,944	215,000	215,000	...
1929-30	2,411,534	1,168,000	1,243,534	918,550	324,984	211,000	95,000	**116,000**
1930-31	2,411,534	1,018,100	1,393,434	785,850	607,584	395,000	...	**395,000**
1931-32	2,411,534	1,202,000	1,209,534	910,590	298,944	195,000	...	**195,000**
1932-33	2,411,534	1,297,600	1,113,934	855,830	258,104	167,500	...	**167,500**
1933-34	2,411,534	1,188,100	1,223,434	714,966	508,468	330,000	...	**330,000**
1934-35	2,411,534	1,333,700	1,077,834	1,037,340	40,494	26,300	...	**26,300**
Totals		8,400,200	8,480,538	6,110,026	2,370,512	1,539,800	310,000	**1,229,300**

COPCO'S modern semioutdoor hydro plant at Big Bend is rated at 80,000 kw

an effective capacity of 133 mw with existing storage in the extreme dry year 1930-31.

The inclusion of off-stream storage would firm the entire capacity on the Klamath River with a resulting capacity gain of 211 mw.

Aspen Lake Project

The three basins, Aspen, Round and Long Lakes, lie in an area to the west of Upper Klamath Lake at elevations which would make tunnel connections possible.

Of 14 different schemes that appeared to warrant attention, each demonstrated the value of financial feasibility of a carry-over project.

Storage and pumping requirements are dictated by the vertical position of the storage and plant capacity in all schemes. The only limitations on generating have been that the turbines must be capable of delivering water at the maximum required rate under the lowest reservoir stage.

The pumping plant will be connected directly to the company's Klamath Falls substation by 12 miles of 125,000-v line.

During the critical years of low flow, the Klamath River plants and the pumped storage plant, while generating, will be required to operate at high capacity factors. All of the existing main generating plants in the system now have, and the future Klamath River plants will have, ample pondage facilities for daily peaking. Regenerative capacity has therefore been limited to that incidental to the pumping operation. Within the foreseeable future, there would be no place on the system load for a regenerative plant operating on daily or weekly cycle. Should a plant operating on a daily or weekly cycle become attractive in the future, such a plant could be installed adjacent to the proposed plant and be operated independently through a separate tunnel between the Upper Klamath Lake and the Aspen Lake reservoirs.

Construction Schedule

The schedule of construction is such that the first stage will provide for the Aspen Lake reservoir. This will make pumped storage available at an early date for conserving and regulating water for both irrigation and power on an annual basis.

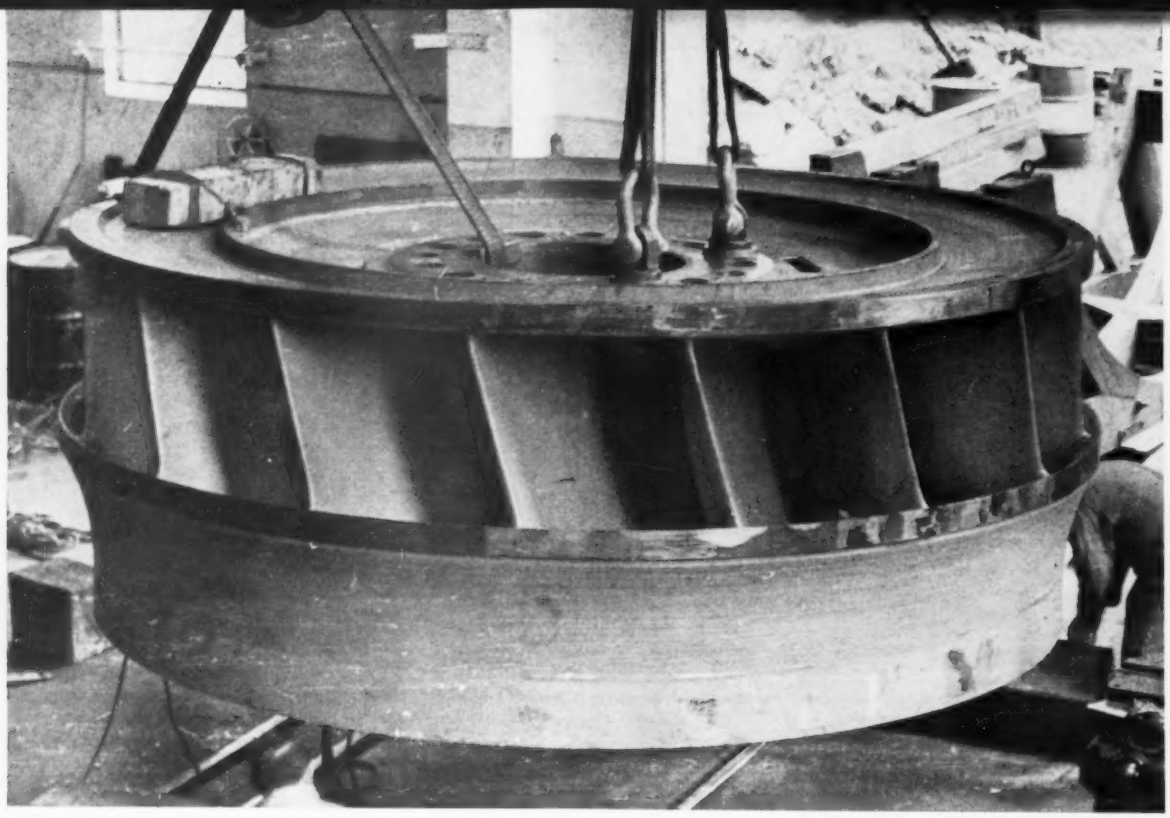
The second stage will include Round Lake and the third stage will include Long Lake.

The fortuitous arrangement of the elevations of the three lakes and the connection scheme makes it possible to operate each lake independently. Thus, under critical water condition, regulation by Aspen alone would save 60,000 acre-ft of precious water by reducing evaporation over regulation using all three lakes.

The Aspen Lake carry-over pumped storage development will enable Copco to approach the decade of the '70s with abundant low cost hydro power. On completion of the proposed projects, the Klamath Basin may well be the first where maximum beneficial use of water occurs within the basin of its origin.

TABLE 3—SUMMARY OF CARRY-OVER STORAGE BENEFITS

Annual energy gain from pumping plant	4,650,000 kwh
Annual energy gain from Klamath River plants existing and proposed	35,600,000
Total annual kwh gain	40,250,000 kwh
Pumping capacity of plant	36,000 kw
Dependable pumping plant capacity at minimum reservoir level	12,000 kw
Capacity gain from Klamath River plants existing and proposed	199,000
Total increase in plant capacity	211,000 kw
Reservoir capacity:	
Aspen Lake	463,100 acre-ft
Round Lake	542,000
Long Lake	270,000
Total storage	1,275,100 acre-ft
Reservoir filling period	6 years
Annual pumping energy	16,000,000 kwh
Estimated cost, including transmission	$26,986,000
Project fixed charges	3,089,000
Pumping energy at 2 mills	32,000
Total annual costs	$ 3,121,000
Annual cost of competitive steam	$ 7,246,600
Annual profit from project	$ 4,125,600

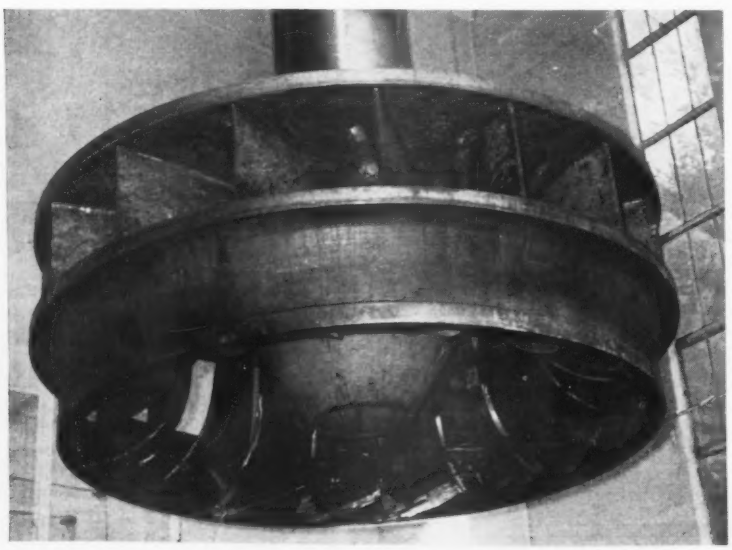


NEW TURBINE RUNNER. Diameter of the discharge ring was increased and design of entrance edge of runner buckets refined

Modernization at Seattle's 30-year-old Diablo plant on the Skagit yields

HYDRO KILOWATTS FOR $30 EACH

A. L. GUSTANOFF. SUPERVISING SENIOR ENGINEER, HYDROELECTRIC PROJECTS, SEATTLE CITY LIGHT



BEFORE MODERNIZATION. Old design can be compared with new above

The city of Seattle gained a rich return by installing larger runners in existing scroll cases at its 30-year-old Diablo plant on the Skagit River in the State of Washington. This increased the capability of the two main units from 129,000 to 156,000 kw, a total gain of 27,000 kw, at a cost of $920,000, or about $34 for each kilowatt.

Considering that the construction of peak hydro capacity at $250 per kw is feasible in this area, based on an alternative steam-electric source, this gain in power is valued at $7 million—a rich return.

While this result, in itself, will undoubtedly interest many concerned with economic generation of hydro power, how it was attained may also be of unusual interest.

Conception of the program probably coincided with the realization that the existing turbine construction favored modifications required

for acceptance of a runner of increased dimensions. A preliminary survey showed such modifications to be possible and quite probably feasible. Ensuing studies indicated that the capacity and characteristics of the power tunnel, its intake and surge tank, the turbine governors and synchronous by-pass valves, generators, transformers and buses were either adequate or could be made so at minor cost. A program of detailed investigation and development of each component was then established and activated.

The major task was development of the new runners. A contract with this purpose was awarded to the S. Morgan Smith Co. of York, Pa. (now Allis-Chalmers, York Works), the company which built the original equipment in the 1930s. The new runner design was one of the first developed in S. Morgan Smith's high-head model test-stand completed in 1956. This excellent new facility enabled thorough investigation and development, especially in the critical areas bordering on cavitation, permitting confident application of the test results.

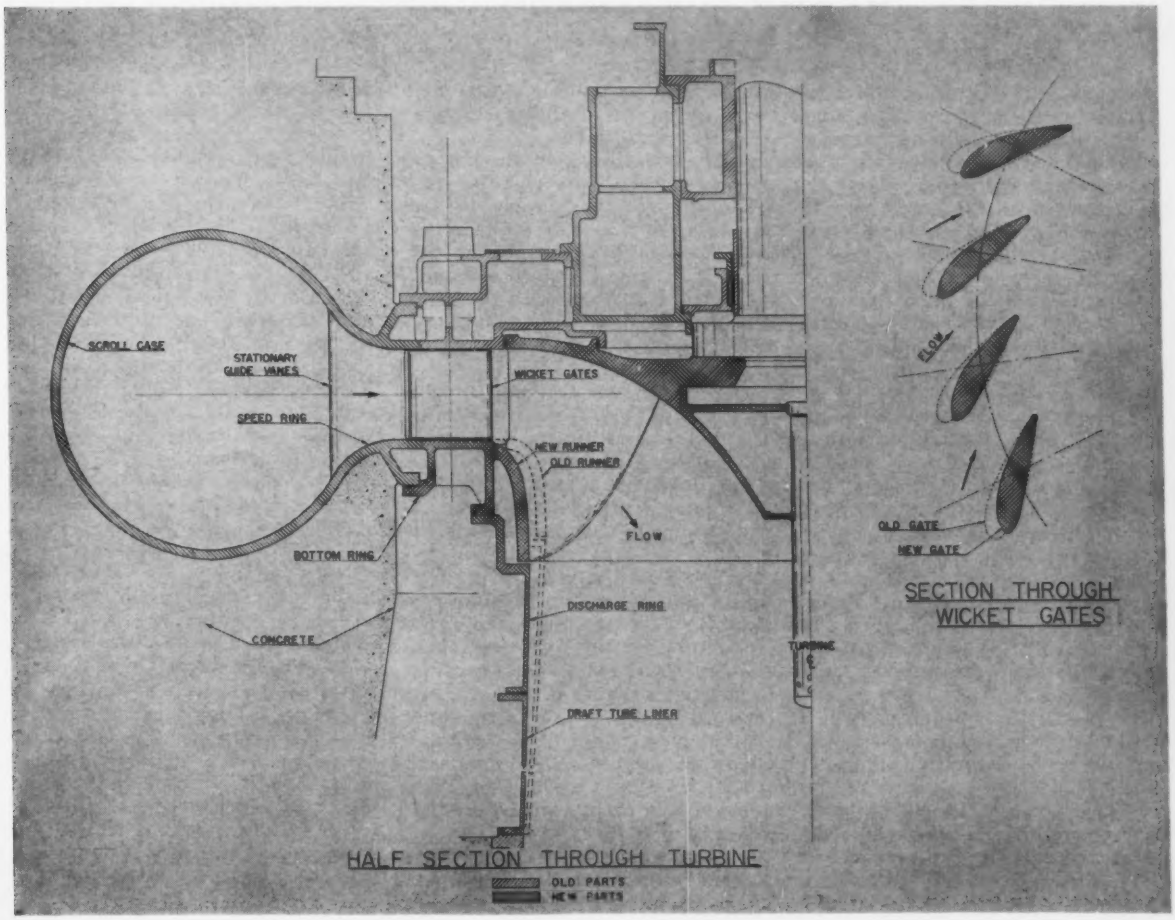
Larger Flow Path Designed

Since the program did not alter the gross head on the Diablo plant, increased power output was to be dependent upon the increased water handling capacity of the turbines. To this end, increases in the cross-sectional areas along the flow path are of prime significance. Since the scroll case and speed ring are embedded in concrete and could not be changed, the available area along this path was improved by replacing the movable wickets with gates of thinner section made of high strength stainless steel, thereby removing considerable bulk from the path of the water. Again, because of the parts embedded in concrete, it was not practical to increase the runner diameter at levels lying above the entrance to the buckets. However, the bottom ring, the discharge rings and draft tube liners are not embedded in concrete and were removable through a pit below the runner. This construction feature made it practical to increase the discharge dimension of the runner several inches. New discharge pieces, dimensioned to match the new runner, were manufactured and installed along with the new runner and wicket gates.

Surge Tank Modified

The treatment of the surge tank to accommodate the increased plant discharge is another interesting item encountered in the program. Water is conveyed to the plant through a 19-ft 6-in. horseshoe-shaped tunnel approximately 2,000 ft in length, which supplies the two main units through a bifurcation and two 15-ft-diameter steel penstocks, each approximately 200 ft in length. The differential type surge tank is located just upstream of the bifurcation. Mathematical investigation in-

Cross section through turbine showing (by shadings and dotted lines) the improvements in the flow path



dicated that blocking off 20% of the port area would cause sufficient differential action to develop in the tank to prevent it from overflowing at full load rejection without generation of excessive water hammer in the turbines and penstocks. This change was made along with an increase in permissible wicket gate closure time from 6 seconds to 8 seconds. Data, extrapolated from field load rejection tests on the original units, confirmed the several data assumptions made in the preliminary calculations. Modifications to the surge tank to adapt it to the modified plant consisted of two steel plate covers for two of the ten differential orifices of the surge tank, a total of 650 lb of steel plate. Subsequent surge tank performance tests substantiated the calculated performance at both full plant pickup and rejection.

Extrapolation of temperature loading tests of the main generators and transformers indicated sufficient thermal capacity to handle the largest turbine output developed in the runner program. Hence, modification of the electrical equipment was not required. Subsequent performance substantiated the correctness of this decision. The generator thrust bearings had been designed for a total load of 465,000 lb. The new runner design limited the increase in runner weight and hydraulic thrust so that the total load coming on the bearing was well within the design value.

That this was safely possible was predetermined from load-deflection measurements using a dial gage held in contact with generator bracket.

This successful program points up several things. It directs attention once again to the fact that there often may be quite a few additional kilowatts locked up in existing older installations, which can be had for little more than just the digging. It gages the 25-year advance in technology, in that the increase in power attained is also a measure of the decrease in the factor of uncertainty associated with today's development facilities. The acceleration of hydraulic turbine development is demonstrated in that many of the pioneers responsible for the original units, about the world's largest when installed, are prominent as leaders among those engaged in wringing out more kilowatts per unit, today, thus adding to system efficiency.

With five years' experience, Edison tells how telecomputing equipment

SPEEDS STREAM FLOW TABULATION

Semiautomatic equipment for reducing water stage recorder chart graphs to mean daily discharge records has proved to be a time-saver for Southern California Edison Co. Experience with the system now totals five years and provides a fast method of tabulating the flow of more than 100 water stage recorder stations. These compiled data protect water rights, establish water rights and prove the company's use of the water being diverted for the generation of electrical power.

Basically, the system involves the electronic conversion of water stage recorder chart readings to IBM punch cards reading in cubic feet per second. The installation, ordered from the Telecomputing Corp. of North Hollywood, Calif., consists of the following equipment: telereader, telereducer, program unit and a modified IBM electric typewriter. In addition an IBM model 523 summary card punch was acquired on a rental basis.

This electronic equipment (which is operated by girl operators), together with appropriate calibration curves, will convert water stage recorder graph records to detail punch card records of discharge. The detail punchcards are then summarized and mean daily discharge records are tabulated, using free time available on the IBM computing and tabulating equipment of the machine accounting department.

Operators, trained on the job, can complete the hourly readings for about one year of the more difficult station records in eight hours, or one month of record in about 40 minutes. This time varies considerably, of course, with respect to different stations, time of year and consequently the number of readings necessary per day of record.

To obtain final readings in cubic feet per second, the station rating curves with coordinates corresponding to the gage heights of the recorder charts are transcribed on sheet plastic templates. Curves are drawn on the bottom side of the template to avoid parallax. Reference marks are scribed on the templates corresponding to the gage heights. The recorder charts are lined up with the template along these reference marks. Since readings are to three significant figures, two or three rating curves are sometimes plotted on a template. In this way the curves may be expanded to read from 0 to 9.99, 0 to 99.9, 0 to 999, and so forth, to give greater reading accuracy.

First step in the procedure is to place a recorder chart on the chart reading table of the contact telereader as shown in Fig. 1. This contains a light box with a glass top. The corresponding stream flow template is then superimposed on the chart. Just below the glass is a cross-wire measuring system. The positionings of the horizontal and vertical cross wires are regulated by the wheels the girl is holding in the picture. When the chart is lined up with the template the lower and upper limits of the discharge and gage height scales are set in the teleducer and locked. This permits the reading automatically of any position of the cross wires within the set range. By setting the horizontal cross wire on the median elevation of the portion of the graph to be read and the vertical cross wire at the point where the horizontal cross wire intersects the rating curve of the template, the readings for both the gage height and discharge will be read out by pressing a foot-operated switch. The gage height and discharge for the next time interval can then be read out in like manner. Time corrections are marked on the chart as needed. Gage height corrections are marked as corrections to the baseline or border of the chart, and are made as the chart is lined up for reading.

Fig. 2 shows a panel of four units, the lower two of which are identical teleducers. One unit may be set up

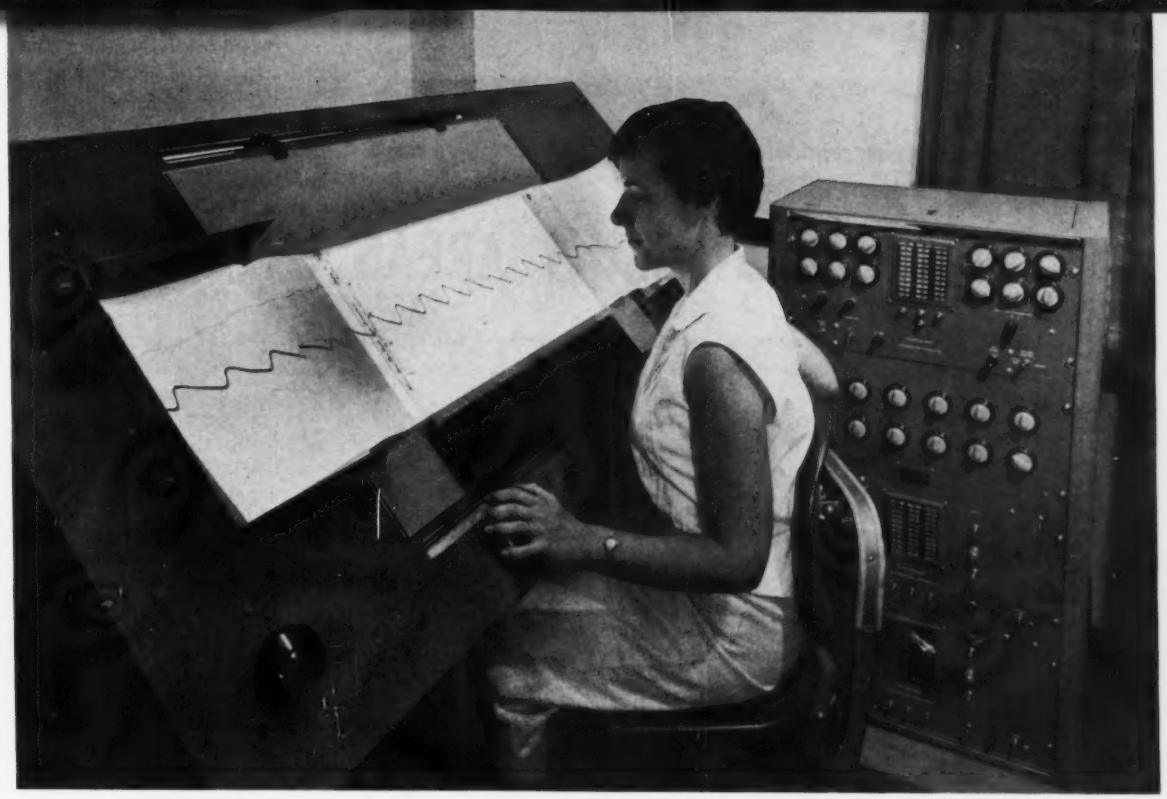
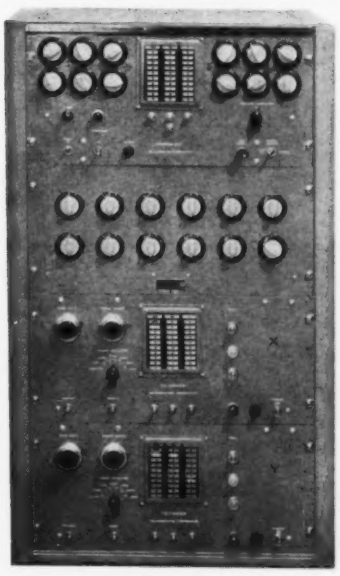


Fig. 1—Recorder chart is placed on reading table of contact telereader. Fig. 2, below, shows a panel of four units

W. A. LANG, CHIEF HYDROGRAPHER, SOUTHERN CALIFORNIA EDISON CO.



to read either the X or Y axis and two are needed in order to read both axes simultaneously. These units are automatic measuring instruments that convert voltages into digital representations. This conversion is in decimal numbers, which are transmitted by means of the program unit (upper unit) to a recording device. Readings can be obtained over a range from negative 999 to positive 999.

The program unit supplies the information from the teleducer and preset constant selector switches on the program unit for transmittal to a sequential readout device or series-parallel readout device such as an electric typewriter or an IBM summary card punch, respectively. The order in which this information is presented to the typewriter may be set manually by the operator by wiring the order on a program board by means of jumper wires.

The information that is normally recorded on the punch card is: the station identification number, the date, the number of hours which the reading represents, a code number for decimal location, the X axis (discharge) reading, the Y axis (gage height) reading, the operator identification number. The procedure identification number is to direct the processing of the cards by our machine accounting department. The computation, summation and tabulation are done using free time available on the equipment of this department. The machine accounting department returns a summary card which contains the station identification number, date, operator number, mean daily discharge and average gage height. Along with these summary cards, a listing of information on the cards is also returned. After checking this tabulation for possible errors, the cards are again given to our machine accounting department for tabulation on our final station discharge form.

Results obtained by reading water stage recorder charts with the telecomputing equipment have been extremely encouraging. On 18 months of record, which were checked against records worked by the USGS as a test for accuracy, there was found to be an over-all deviation of only 0.3%. Having the discharge record on punch cards provides a convenient method of handling the data when using it for related studies such as flow duration curves and combinations of runoff records.

While this is not the final answer to processing water stage recorder charts, it is a satisfactory intermediate step whereby considerable time can be saved without loss, and very likely a gain, in accuracy. By permitting the use of trained girl operators, the system frees technical personnel for more *technical* work with a resulting increase in morale and a reduction in cost. Since its installation, this equipment has been adopted to the processing of many other charts with similar benefits in time saving, accuracy and morale.

Soil Conservation Service reports on water supply outlook. Forecast:

IN THE WEST MANY AREAS WILL BE DRY

HOMER J. STOCKWELL, WATER SUPPLY FORECAST SECTION, SOIL CONSERVATION SERVICE, PORTLAND, OREGON
J. ALDEN WILSON, ASSISTANT SNOW SURVEY SUPERVISOR, SOIL CONSERVATION SERVICE, BOISE, IDAHO

The 1960 outlook for seasonal streamflow from the snowpack in the high mountain watersheds of the West is poor in the southern portions of the Columbia Basin, California, Nevada, and southern and central Utah. Only in Arizona, New Mexico and Colorado is streamflow expected to be above normal. Over the upper Missouri and Columbia River basins streamflow is expected to range from 70 to 90% of normal in most areas.

Major reservoirs where water is stored for power production have near average storage. No adverse effects are expected this year. However, there may be some deficiencies in smaller reservoirs with power facilities in areas where streamflow forecasts are well below normal. Shortages for irrigation water are more widespread, particularly on small streams where storage is not available for late seasonal use or where carry-over storage is limited. The need for more storage, especially on smaller streams, is apparent.

Water supply outlook for 1960 is based on April 1 measurements on over 1,400 snow courses and 100 soil moisture stations in western mountains, made by the U. S. Department of Agriculture, Soil Conservation Service and many cooperators.* In addition, other basic data, such as precipitation and streamflow, reservoir storage, and plans of management of water-using organizations are considered in making streamflow forecasts and an appraisal of water supply outlook conditions.

In the Columbia Basin, the northern tributaries are expected to flow near 80% of normal. The flow of the Snake River is forecast in the 60 to 70% range. No shortage is expected along the Snake River, but severe shortages appear certain for the smaller tributaries in central Idaho. Soil moisture conditions over most of the basin are relatively good.

The flow of upper Missouri River tributaries in Montana will be near 80% of normal. No shortages for irrigation are expected except for late season on small streams without storage.

Yellowstone River tributaries in Wyoming also have deficient snowpacks. Streamflow will be adequate along the streams to meet demands except for small unregulated streams in late summer. The flow of the North Platte will be extremely short, in the range of 60% of normal. Storage and inflow will barely provide an adequate water supply. Average or better summer precipitation will be necessary to reduce irrigation water demand. Power production could be curtailed on this system.

Seasonal runoff in Colorado and New Mexico will be above normal in most streams. Limited shortage will probably occur on the lower Arkansas because of the lack of reservoir storage. Winter and early spring runoff into the Salt and Gila reservoirs in Arizona has been the best for several years. Storage is above normal. Surface water supplies will temporarily reduce demands on groundwater.

Runoff in California streams flowing into the Central Valley will be seriously deficient in 1960. Snowmelt season runoff for the majority of streams will be in the range of 50 to 60% of normal, only slightly better than the streamflow of 1959. The consecutive dry years will be reflected in the lowering of groundwater tables in many areas.

Great Basin streams in Utah and Nevada will have flows near 50% of normal. A few are forecast at less. Streams in northern Utah range up to near normal.

Forecasts for the major streams of the West as compared to normal for the April-September 1960 period fol-

Prospective stream flow in the West for the period April-September 1960 (as of April 1)

* The Soil Conservation Service coordinates snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Forest Service, Geological Survey, other federal bureaus, various departments of the several states, irrigation districts, power companies and others. The California State Department of Water Resources, which conducts snow surveys in that state, contributed the California figures appearing in this article.

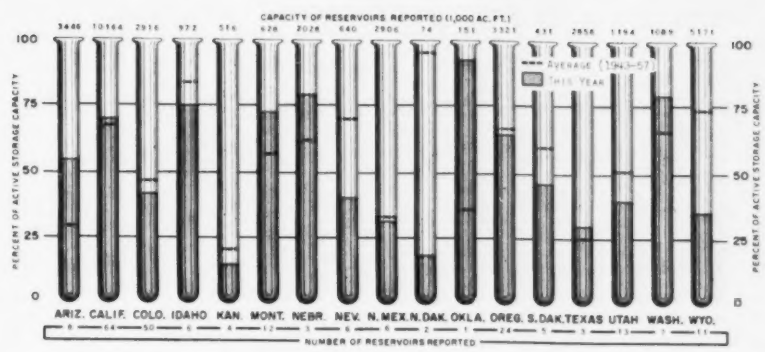

CAPACITY OF RESERVOIRS REPORTED (1,000 AC. FT.)
3446 10164 2916 972 516 626 2028 640 2906 74 151 3321 431 2858 1154 1089 5171
AVERAGE (1943-57)
THIS YEAR
PERCENT OF ACTIVE STORAGE CAPACITY
100
75
50
25
0
ARIZ. CALIF. COLO. IDAHO KAN. MONT. NEBR. NEV. N.MEX. N.DAK. OKLA. OREG. S.DAK. TEXAS UTAH WASH. WYO.
8 64 50 6 4 12 3 6 6 2 1 24 5 3 13 7 11
NUMBER OF RESERVOIRS REPORTED

Chart shows reservoir storage on April 1

STORAGE IN LARGER RESERVOIRS NOT INCLUDED ABOVE

NAME OF RES.	USABLE CAPACITY 1000 AF	USABLE STORAGE 1000 AF APRIL 1, 1960
ARIZONA		
LAKE MEAD	27,207	19,107
LAKE MOHAVE	1,810	1,568
LAKE HAVASU	619	545
CALIFORNIA		
FOLSOM	1,010	702
BERRYESSA	1,600	1,142
CHERRY VALLEY	268	56
PINE FLAT	1,001	385
ISABELLA	552	91
CACHUMA	206	181
TWITCHEL	250	0
NACIMIENTO	350	101
CASITAS	248	7
IDAHO		
CASCADE	654	443
ANDERSON RANCH	423	324
LUCKY PEAK	278	230
PALISADES	1,202	876
MONTANA		
FORT PECK	19,410	11,360
CANYON FERRY	2,043	1,938
FLATHEAD LAKE	1,791	868
HUNGRY HORSE	3,428	2,841
TIBER	1,316	666
NEVADA		
LAKE TAHOE	732	330
NORTH DAKOTA		
GARRISON	18,100	5,020
SOUTH DAKOTA		
FORT RANDALL	3,800	3,220
UTAH		
BEAR LAKE	1,421	995
UTAH LAKE	1,149	519
WASHINGTON		
ROOSEVELT LAKE	5,072	2,724
BANKS LAKE	762	537

KANSAS STORAGE INCLUDES STORAGE IN JOHN MARTIN AND GREAT PLAINS RESERVOIRS IN COLORADO. TEXAS STORAGE INCLUDES RED BLUFF RESERVOIR IN TEXAS AND ELEPHANT BUTTE AND CABALLO RESERVOIRS IN NEW MEXICO. NEBRASKA STORAGE ON PLATTE RIVER ONLY.

Reservoir storage data supplied by Bureau of Reclamation, Geological Survey and water organizations

low. Forecasts in California are for April-July.

Columbia River at The Dalles, Ore.
95,600,000 acre-ft or 90%
Missouri, Fort Benton, Mont.
2,955,000 acre-ft or 82%
Colorado, Grand Canyon, Ariz.
8,860,000 acre-ft or 97%
Sacramento inflow to Shasta Res., Calif.
1,580,000 acre-ft or 80%
San Joaquin below Friant Res., Calif.
670,000 acre-ft or 53%
Rio Grande, Otowi Bridge, N.M.
1,008,000 acre-ft or 158%

The accompanying chart showing the status of reservoir storage by states, and the map with approximate runoff forecasts indicate graphically water supply conditions for 1960. In the following paragraphs water supply conditions by states are briefly reviewed.

Arizona—Early winter precipitation established a heavy snowpack at higher elevations. Spring runoff has been well above normal. The water supply outlook for Arizona is very good, as compared to recent years. Water stored in reservoirs is 184% of the 1943-57 average. There should be some carry-over storage for next year in the Salt River Valley and a few other areas.

Forecasts of flow for April and May on the Salt and Gila main stems are about 125% of normal. An exception is the Verde above Horseshoe Reservoir, which is only 62% of normal.

California – The California Department of Water Resources reports that this is the second consecutive dry year for California. Runoff of streams is below normal in all areas. Seasonal precipitation to date and the water stored as snow at the higher elevations are well below average in all areas. Resultant April-July streamflow, as indicated by these and other factors, will be in the range of 50 to 60% of average on most snow fed streams, with extremes of 25% of average on the Tule River and 80% on the Trinity River.

In California, April 1 is generally considered to be the end of the snow accumulation season and the beginning of the melt period. After April 1 there is little hope of improving the water supply situation. This will be a dry year, and although not as bad as last year, it does follow a dry year. The shortage of water will result in a further lowering of groundwater levels in many areas, in addition to the more immediate and apparent affects.

The state-wide precipitation average for the season to date is about 80% of normal. This is approximately 15% higher than on this date last year, but about the same percentage as at the end of last month. Storms during March brought above normal precipitation to the northern portion of the state, and improved water supply conditions for that area. In the southern portion of the state, however, where the need for water is much more critical, March precipitation was well below average.

As of April 1, snow stored water was much below normal in all snow accumulation areas of the state, ranging from about 50% of average in the Kings-Kern area to 75% in the upper Sacramento River basin. Although storms in early and late March deposited significant deposits of snow, the high temperatures during mid-March melted large segments of the lower elevation snowpack. As a result, forecasts of April-July runoff on most streams have been lowered from those of one month ago.

Colorado—Water supplies should be adequate along most of the principal snowmelt streams in Colorado for 1960. Mountain snowpack as of April 1 is above normal at higher elevations. Mountain and valley soils are in excellent condition, which will tend to increase snowmelt runoff and cut down on early season irrigation demands.

Reservoir storage is slightly above normal on the South Platte and below normal on the Arkansas and Rio Grande. Because of the lack of storage, the outlook is only fair on the Arkansas below Pueblo.

In northwestern Colorado, streamflow will be slightly more than normal and adequate to meet all but late season demands in small tributaries. The San Juan, Dolores, Animas and Rio Grande drainages will have excellent water supplies for the 1960 season.

The flow of the South Platte tributaries near the mountains is expected to be near normal. With Colorado-Big Thompson supplemental water, the outlook is good.

Idaho – Snowfall throughout Idaho for March was variable, but seasonal totals continued below normal. The main rivers used for irrigation, such as the Snake, Payette and Boise have excellent carry-over storage and a normal water supply is in prospect even though the snowpack on the watersheds is far below normal.

The small rivers running north and south into the Snake, such as Salmon Falls Creek, Goose Creek, Trapper Creek and Big Wood, Little Wood, Big Lost and Little Lost Rivers, with limited storage facilities, face a critical water shortage because of the low carry-over storage and low streamflow in prospect for 1960. Streamflow in northern Idaho is expected to be about 80% of normal, which should provide adequate irrigation water supplies.

Water users are planning for the most efficient use of water in the areas of extreme shortage.

Montana – The 1960 water supply outlook for Montana is only fair. Exceptionally warm weather during the last two weeks of March removed most of the low elevation snow. This warm period has ripened the high elevation snowpack, which indicates an early spring runoff.

High base flow in the streams during the winter and an above normal fall precipitation raised the forecasts above that which normally could be expected from the snowpack. Soil moisture under the snow throughout the state is exceptionally high for April 1.

The Jefferson, Madison and Gallatin Rivers will combine to make a close to 80% normal snowmelt for the Upper Missouri.

The Columbia River basin snowpack in Montana is only 75% of normal. The South Fork of the Flathead River below Hungry Horse Dam is forecast at 70% of normal. The Flathead River at Columbia Falls is forecast to flow 1,819,000 acre-ft during the April-September period, or 79% of normal. This is 40% less flow than last year.

Nevada—Nevada water supply outlook for the coming summer is poor to fair. The outlook declined during the past month due to below normal snowfall, except for near normal snowfall at high elevations in northeastern Nevada. This lack of March snowfall coupled with unseasonably high temperatures and warm winds, and dry mountain soil conditions has resulted in the downward revision of streamflow forecast estimates from March 1.

Reservoir storage is low, with only 58% of normal April 1 storage, None of the principal reservoirs in the state is expected to fill to capacity. Most irrigation district managers and water officials expect sufficient water to avoid serious crop damage. However, careful management of limited water supplies by Nevada water users through efficient irrigation practices plus some concentration to lesser water using crops will be necessary. If precipitation continues to be deficient on the Humboldt watershed, water supplies could be extremely deficient.

New Mexico—The water supply outlook for New Mexico is much improved over last year and will probably be similar to 1957. Snowpack in New Mexico is about 125% of normal. Soil moisture conditions are better than they have been since 1957. High temperatures near the end of March melted the low snow. Streamflow is increasing.

Storage in Elephant Butte and Caballo reservoirs is below normal, but not critical. Storage on smaller irrigation systems is generally below normal. Inflow to all reservoirs should be above that of recent years.

Conchas reservoir on the Canadian River has above normal storage and, with above normal snowmelt runoff, this area should have adequate water supplies. Storage in Alamogordo on the Pecos River is almost twice normal but less than last year.

Most irrigated areas that depend on snowmelt streams for water should have a good irrigation season as compared to the past few years.

Oregon—Outlook for irrigation water supplies in Oregon improved slightly during March but still is below average in all areas and poor in many. Forecasts range from 60 to 85% of normal with a low of 47% on the Silvies River. Reservoir storage is near average. Late season shortages of irrigation water will be general in practically all areas of the state, with the exception of the Rogue and Klamath where barely satisfactory water supplies are anticipated. The Harney Basin has the poorest outlook in the state. Other areas where runoff shortages will be relatively severe include several parts of Wallowa, Baker and Union Counties, John Day and Crooked Rivers and their tributaries.

Utah – Snowmelt season streamflow will be below normal for most of the state. Water supply shortages are expected on the Upper Sevier and Virgin Rivers and adjacent streams, the Spanish Fork and Strawberry Rivers, East Canyon Creek near Morgan, Chalk Creek near Coalville, and the main stem of the Bear River in the Woodruff-Randolph area. Forecasts for these streams range from 50 to 65% of normal. The streams in the Uintah Basin are forecast at 70 to 80% of normal. Water supplies for the remainder of the state will be near 80% of normal. The North Fork of the Ogden River, Salina Creek and streams in the Monticello-Blanding area of southeastern Utah are forecast at 110 to 120% of normal.

Reservoir storage is only 75% of normal not including Utah and Bear Lakes.

Washington—The water supply outlook for the State of Washington varies from fair to poor. Forecasts of runoff on the Columbia, Chelan, Methow, Cowlitz and Lewis Rivers and Ahtanum Creek are for flows 80% of normal or better. The remainder of the streams in the state can expect less than 80% normal runoff during the April-September period.

Heavy precipitation this past fall primed the soil at higher elevations, which will materially help the spring runoff picture and should maintain better late summer flows than could be expected from the below normal snowpack. Base flows as of November 1959 were exceptionally high. This factor also tends to increase forecasts over that expected from the snowpack.

Reservoirs used for irrigation in the state have more water in storage than normal for this time of year, except Franklin D. Roosevelt Lake. The irrigation picture is good for those areas below reservoir storage. Runoff during March was generally above normal for all streams in the state, except those near the Oregon border.

Wyoming—Snow water content measured in mountain areas of Wyoming on April 1 was seriously deficient, generally in the range of 50 to 75% of normal. Soil moisture under the snow is above normal, which will add slightly to the expected runoff. Seasonal runoff will be short and reservoir storage will continue to be reduced. Anticipated flows range from about 63% of normal on the North Platte in southeastern Wyoming to 70% of normal on the Green and Wind Rivers. The Snake at Moran is forecast at about 60% of normal.

Reservoir storage on the North Platte is 80% of normal in the large reservoirs. In combination with inflow, water supplies along the North Platte should be reasonably adequate this year. Tributaries will experience shortages. Soil moisture conditions in irrigated areas are relatively good.

Labor-saving device is designed and built by Pacific Power & Light metermen

TESTER UPS OUTPUT 300%

WAYNE J. HUNTER, METER FOREMAN, PACIFIC POWER & LIGHT CO.

Metermen in the Portland meter department of Pacific Power & Light Co. needed a new way to thoroughly test G-E demand registers. The hand checker method was far too slow and, in certain respects, unreliable.

The problem was solved by a gang-tester designed by the author and built by William Garnett, both of the PP&L meter department.

This labor-saving device functions as an in-service tester, which reveals the same faults that might occur in actual service. Because the machine can test 10 registers at one time, all on one voltage, or as many as five registers on each side at different voltages simultaneously, **test output is increased 300%.**

The author is shown with gang tester he designed

How It Works

Registers are mounted one above the other on studs located on each side of two aluminum channel uprights. Ten optical lenses are mounted in barrels and press-fitted in the channel pieces at convenient points for observation, while mesh adjustment is being made. Screwdriver holes are provided for the adjustment. The worm wheels on the registers are driven at synchronous speed by a common worm shaft consisting of a hollow tube of ½-in. aluminum alloy. The shaft is supported at the lower end by a small cone-type ball bearing salvaged from a discarded Sangamo type LG motor and at the top by a steel axis shaft extending through a ½-in. brass plate.

Appropriate gearing connects the upper axis shaft to the synchronous motor which was recovered from a type CCW Graphic to provide motion to the ½-in. central tube. The exterior of the tube is cut with 41 threads per inch to agree with the worm wheel tooth spacing.

Within the base of the tester are two transformers, two capacitors and two rotary-type, five-position, two-pole switches. This equipment provides the proper voltage to the individual synchronous motors on each register. The leads for each register are brought up through two diagonal corners of the channel posts and are terminated by a thread-type connector which was converted to a compression-type connector by adding two small springs and two bronze clips.

In operation the kwh dials of the register and the demand pointer advance as a function of the central drive shaft. At the end of the demand interval the register motors reset the pointer pushers and the test is completed.

Kwh dials as well as the demand pointer will all read a definite predetermined figure according to the gear ratio of the main shaft drive motor; thus kwh and demand gear ratios as well as the accuracy of the register motors are all verified by the test.

Though the burden on the main shaft motor is less than one-tenth of that which would pull it out of synchronization, a safety strobe lamp illuminates strobe marks on the motor at all times.

Frees Metermen

This new tester provides a means for Pacific Power & Light Co.'s metermen to give their 4,500 mechanical demand registers a regular four-year check in fewer than six months of man-hours, whereas former methods required 1¼ man-years. Furthermore, the use of the tester leaves the meterman free to perform other tasks once he has set up the registers for their 30-minute check.

The 50-kv aluminum structure is put into position at Tacoma City Light's Chambers Substation by department personnel

Because experimental design reduced downtime and brought other economies . . .

MORE ALUMINUM SUBSTATIONS FORESEEN

C. E. HEENAN, SUPERVISING CIVIL ENGINEER, TACOMA CITY LIGHT

An ever-expanding use of structural aluminum in electric utilities operations is foreseen by Tacoma City Light engineers.

With aluminum we feel that "downtime" on electrical substations for painting and similar maintenance can be virtually eliminated.

Early in 1959 the Light Division completed the first all-aluminum distribution substation. The station, called Chambers substation, is located in a rural area, southwest of the city limits. It has a capacity of 3,000 kva and is rated 52.5 kv to 13.8 kv. The design was experimental and was constructed to evaluate the performance of aluminum structurally, electrically and aesthetically as a substitute for other materials from a maintenance, economic and performance standpoint. The following information deals primarily with the structural applications of the 6061-T6 alloy.

The 52.5-kv tower is of particular significance, since it was designed to be interchangeable with scores of unit substations, which are placed throughout the system. In spite of the fact that the configuration was not the most efficient from an aluminum design standpoint, the structure weighs but 40% of its steel counterpart. This structure, as well as the 13.8-kv structure, is of an all-bolted design. The 52.5-kv tower is completely assembled on the ground, lifted into position with a mobile crane, plumbed and then final tension is applied to the bolts. The 13.8-kv structure was assembled on the ground in frames and lifted into position without the aid of mechanical lifting devices.

Cost data on this first installation and on two subsequent 52.5-kv unit substations point up the fact that in first costs the aluminum stations are very nearly on a par with our existing painted and galvanized structures. The erected cost of a 52.5-kv tower is approximately $1,250. It has been estimated that a painted tower of this type should be repainted once each five years at a cost of $200. The maintenance painting is further complicated in that a station must be taken out of service. Several other economies were brought about by the use of aluminum. One of these is the elimination of a separate ground wire circuit for lightning arresters—the aluminum structure is expected to carry to ground any lightning surges that may occur. Another important advantage was the convenience of field drilling, since quite often electrical equipment mounting dimensions are not known at the time of fabrication. In painted and galvanized structures, field drilling is usually frowned upon because of the rusting that invariably takes place at these points. Aluminum structures are being detailed calling for field drilling where mounting dimensions are unknown.

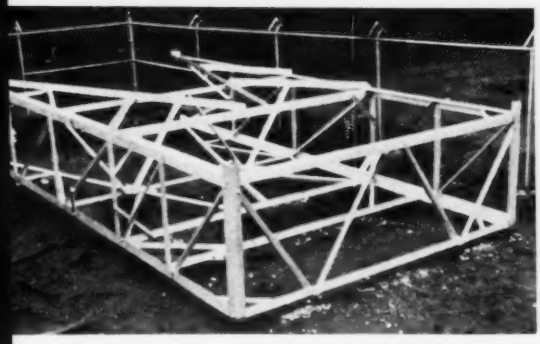
Problems Eliminated

No great difficulties were encountered in the fabrication or the erection of this first station. All fabrication and erection, as is the custom in our smaller unit substations, was performed by Tacoma City Light personnel, using regular steel shop tools and techniques. Power woodworking tools were also used for making some of the cuts. Since this structure was of the all-bolted type, no specialized welding equipment was required. The all-bolted structure was not without its problems, however, especially fit problems in the vicinity of the all-bolted base shoe. These problems have been eliminated in subsequent structures. Another problem in this first station was the high cost of the 2024-T4 erection bolts. Bolt costs ran approximately 10¢ per pound of completed structure compared with the ½¢ per pound figure for an equivalent steel structure. Aluminum-coated steel bolts were tried in later structures, but while more in line costwise were not entirely satisfactory from a corrosion standpoint since the coating had a tendency to flake off. Quantity buying of the aluminum bolts will reduce this figure somewhat, but the costs are still disproportionally high. Representatives of the major aluminum suppliers assure us that they are aware of the problem and are working on a suitable fastener.

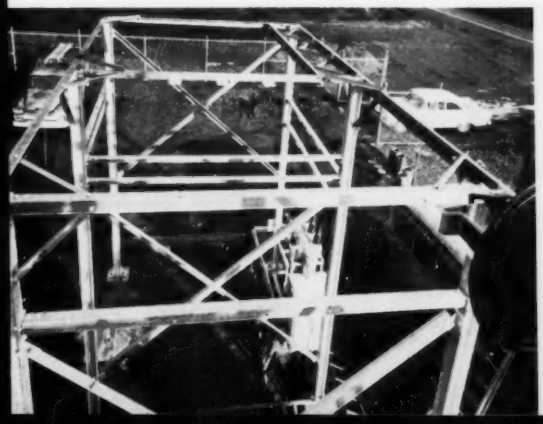
Larger Station Being Designed

Our experience with aluminum to date has been a favorable one, so favorable in fact that we are currently designing a 230/105-kv substation rated at 450,000 kva, entirely of aluminum. Bids for the fabrication of this station, which will ultimately contain some 100,000 lb of aluminum, are expected to be called later this year. Erection will be performed by our own crews.

The 50-kv aluminum tower was completely assembled on the ground, lifted into position with a mobile crane. Assembly job was done by City Light men



The 13-kv structure, below, was assembled on the ground in frames, then was lifted into position without need of mechanical lifting devices



The 50-kv structure was designed to be interchangeable with scores of other substations on the Tacoma system. Since it was of all-bolted design, no specialized welding equipment was required

Berkeley Co-op First

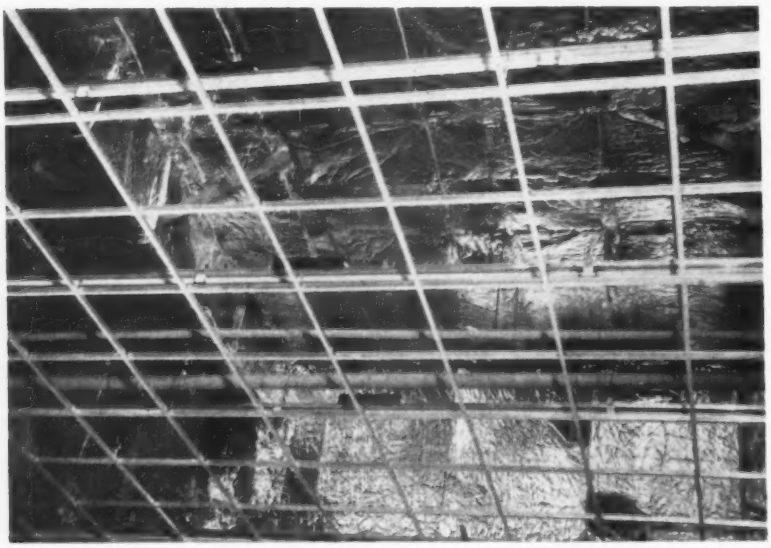
"LUMINOUS" Supermarket

Luminous ceiling makes a comfortable buying area where attention is on merchandise

With a luminous ceiling over its 64x116-ft sales area, the new supermarket of Consumers Co-op on Shattuck and Cedar in Berkeley is unique in its lighting. It is also one of the first luminous ceiling installations made with VHO 1,500-ma fluorescent lamps, and it appears to be proving a very comfortable and admired buying environment by the store's patrons.

The design of Hachiro Yuasa, AIA, the lighting was engineered by Kasin, Guttman & Malayan. Red Top Electric Co. made the complete installation, including the ceiling manufactured by United Lighting & Ceiling. A. B. Lahti was general contractor.

Plastic panels of decorated design are suspended on an aluminum grid 16 ft above the floor. The single lamp fluorescent strips are mounted 32 in. above on 5-ft 4-in. centers in continuous rows fed from one end by flexible conduit through the insulation curtain to outlet boxes mounted there.



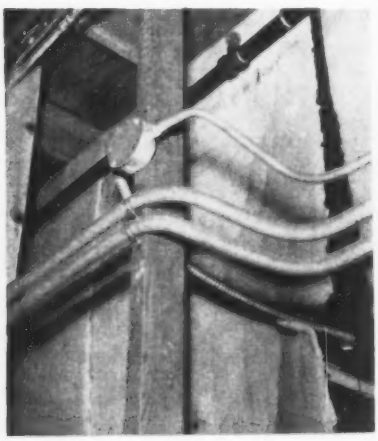
Very high output lamps on channel below reflective plenum and above plastic panels

Lamps are controlled in groups by contactors mounted in the lighting panels mounted on the main floor. Reflectivity is increased by the aluminum material with which the plenum is lined. Down spots are installed over some sales areas to give an additional intense light emphasis. Lighting levels on merchandise averages close to 100 f-c and vertical levels on shelf merchandise is also high because of the diffusion. Ceiling brightness is so low as to be hardly made conscious.

Over check stands under a lower ceiling decorative Prescolite downlight hoods and area lighter-type fixtures over the entranceway provide contrast.

Other wiring features include the 1,200-amp, three-phase, four-wire, 120/208 service to the second floor main switchboard room which also houses 10 compressors of from 3 to 7½-hp for case cooling. These are fed by a 100-amp G-E DH plug-in duct. Seven panelboards are fed from the main switchboard.

Each row connected by flex to outlet box



Plug-in bus from board serves compressors

ELECTRICAL WEST
Construction News

For
-contractors
-consulting engineers
-lighting engineers
-wiring designers
-distributor salesmen
-all interested

ALASKA'S LICENSE BILL--Both houses of the new Alaskan Legislature passed an electrical license bill for examining and licensing of electrical contractors as firms, not as individuals. The act sets up a board of three contractor members appointed by the governor and confirmed by legislature for staggered terms of three years. It will hold annual meetings and two license examinations a year at least. No one may act as a contractor in the state without being licensed by the board. Home owners are exempt only on work on their own premises not for sale. Original license fee is $100 with $50 renewal. Applicants designate a supervisory employee or member of the firm to take the examination who is designated as administrator but may not qualify as such for more than one license.

IMPROVEMENT CLAUSE--Recognition that both contractors and union members need market development and improvement of methods is made in new agreements for both inside and outside electricians effective March 1 between Alaska Chapter, NECA, and Local Union 1547, IBEW. Such a joint program is now being developed, John A. Scheffer, NECA chapter manager, states. It is aimed particularly to provide stimulus for employment during the winter months between December through April, normally months of unemployment. A "winter time make work program" is being studied by a joint committee to be started in October for a trial run . . . New scale for journeyman wireman is $5.55 per hour with a $10 subsistence per day on remote jobs and travel expense beginning at 40¢ per one-way mile for the first 20 miles and 20¢ up to 25 miles. Journeyman linemen rates are the same.

ELECTRONICS JURISDICTION--Work stoppage similar to that reported at Cheyenne occurred at Vandenberg Air Force Missile Base recently when IBEW picketed because Philco Corp., a contractor installing technical equipment, was doing so with technicians at less than the $4.35 hourly scale. The dispute idled 3,000 other organized workers in the base for four days before being settled.

SWIMMING POOL DANGER--The fad for swimming pools is creating some headaches for utilities, city officials and inspectors. These headaches are a prime concern lest the swim devotees electrocute themselves through ignorance of their danger. City and county ordinances covering all phases of swimming pool construction and location were recommended strongly at the IAEI Southern California Chapter. PG and E and other utilities have prepared suggested code requirements covering location relative to service drops or public utility easements.

FEUD ENDS--Edwin F. Guth Co., lighting fixture manufacturer of St. Louis, and the IBEW have ended a 21-year disagreement and the company's lighting products will now carry the union label.

REWARDED--Northwest District of the General Electric Wiring Materials Sales Division won its national contest again and enjoyed as a reward a sales meeting at Palm Springs recently. . . One of the prime movers of the district sales, Les Johnson of Salt Lake City, expects to retire Sept. 1.

CONDUIT MANUAL REVISED--A revised and improved design manual on steel electrical raceways has just been published by American Iron & Steel Institute committee on steel electrical raceways. Well worth the dollar charged for it, it is a reference book on codes and standards in wiring design, basic design considerations in wiring layout, details of all of the steel raceway systems, applications to hazardous locations, uses in residential and farmstead wiring, plans and specification data and various reference material. Its illustrations and diagrams visualize code provisions and requirements. Obtainable at 150 E. 42d St., New York 17.

WANTED LAW—Asking the city council of Honolulu to pass a bill calling for one journeyman for every electrician apprentice, Pacific Electrical Contractors Assn., IBEW Local 1186 and the Building & Construction Trades Council were turned down by Mayor Blaisdell's veto. The mayor claimed it was restrictive and a matter that should be dealt with by union-management negotiation, not city legislation.

NAME CHANGED—Three of the separate electrical industry funds in the Bay area have taken steps to change their official name to Electrical Industry Construction Council. These are the funds set up by the Santa Clara-San Benito, the Contra Costa and the Solano-Napa Counties joint industry groups. . . . The councils of both the Contra Costa and Solano-Napa county groups have earmarked cooperative funds for builder advertising in support of the Medallion program of home wiring.

DISTRICT 9—Representing the various chapters of NECA in District 9 of California and Nevada, has established an office for its secretary-treasurer, Ernest Kramm, at 1122 B St., Hayward. Kramm also acts as public relations representative for the council.

ESTIMATING MANUAL—A new and very useful book recently published by Gulf Publishing Co., Houston, Tex., is "Estimator's Electrical Manhour Manual" by John S. Page and Jim G. Nation, who have previously had published a piping manhour manual by the same company. The manual is particularly complete and simple to use with very readable tables and covers not only interior wiring, lighting fixture installations, panelboard and cabinets, underfloor and bus duct, motor communication systems, but also outside construction and underground duct and cable laying. It sells for $10 a copy, is 7x9 in. in size with a spiral binding, permitting flat opening.

RLM SPECIFICATIONS BOOK—The 1960 edition of the RLM Specifications Book contains three new features and many upward revisions of its standards. It is available without charge from the RLM Standards Institute, 326 Madison St., Chicago 6. The new inclusions are for industrial lighting units with 1,500-ma lamps. Many component standards have been revised upward also.

Equivalent to enlarging of the office was to make every inch usable by a new high level lighting job. Thus United Electric . . .

PROVES SALES THEORY ABOUT LIGHTING

One of the reasons given to office building managers for upgrading the lighting in rental premises is that it makes every square foot of area usable and hence worth its rental. When S. Y. Lakin and C. F. Critchley, owners of Salt Lake City's fast growing independent distributor of electrical supplies, United Electric Supply, needed more room to expand its office and install machine bookkeeping, they put the theory in practice. Part of the customer city desk area was taken over and every inch of office space was made more useful by the installation of a complete lighting system. It consists of 24 Smoot-Holman Perfect Vision 8-ft louvered fixtures mounted in six continuous rows on 26-in. centers and delivering 200 f-c initially, 175 f-c maintained. This is well above the levels in the IES revised standards for office lighting.

Commenting on the results after meter checks and experience working under the job Stan Lakin said, "No matter where desks or files are placed in the 1,600 ft of office area the lighting is not only adequate but free from shadows."

Stan Lakin, co-owner—behind him the remodeled residential fixture display

Other remodeling included that of the adjacent fixture display where United, as only wholesale distributor between Denver and the Coast, has a complete working display of Virden fixtures. Contractors can and do bring their customers to the display to pick out fixtures and accessories they want installed. There are 20 separate circuits installed to permit lighting of any or all fixtures.

A parking lot for 30 cars at the rear likewise permits more service for pickup orders from the rear. An intercom system links all departments for better communication. It is all a part of a continuing program of improvements to anticipate and fulfill the requirements of the trade in the area, which itself is experiencing rapid industrial and residential growth. Lakin and Critchley have done so since they bought the business in 1945 from the estate of the former owner.

REQUIREMENTS OF STARTERS

TOM HUGHES, ELECTRICAL SAFETY ENGINEER, CALIFORNIA DIVISION OF INDUSTRIAL SAFETY

Motors and Controls—XII

We have discussed the source of electrical supply, the branch circuit disconnecting means for individual motors and the control circuits. We come now to the means controlling the motor (starting and stopping it).

On very small motors, or motors that run continuously (such as clocks), the attachment plug is permitted by the codes to be used as a starting or controlling means. This is certainly a makeshift arrangement (where the motor is started and stopped daily or draws an appreciable current) and will eventually destroy the effectiveness of the plug receptacle contact spring tension and limit its current passing ability.

Every self-respecting device of this small class (from an electric razor on up) has some kind of a switch or control incorporated in its design today. Control devices for the larger motors will be covered later.

The codes require that, where the motor is out of sight of the operator or automatically controlled, suitable running-overcurrent protection be provided for small motors and it must be provided in practically all cases for the larger motors.

In the small single-phase motors, the running protection can be built into the motor at the factory or installed later by the user. This is usually a bimetallic thermal-electrical relay that directly opens one conductor of the motor leads. Since the normal type, available at supply houses, only opens one conductor it is only suitable for single-phase motors. An automatic two-pole protector could be applied in two leads of a three-phase motor, if available.

This small device may be actuated directly by the heat of the motor case or it may have an electro-thermal conductive element inserted in the motor lead it is to open. Other self-contained protective relays can be obtained and inserted at any point in the motor leads to satisfy the requirement for running protection with small motors.

All three-phase motors in the nominal 440-v class must have controllers rated for the line voltage (usually 500-v rating) and the locked-rotor current of the motor served. For motors rated under 250 v and 2 hp, the controller may be an "ampere-rated" switch if its ampere rating is at least twice the running current rating of the motor.

While a motor-rated switch is physically able to start and stop the motor under all normal conditions, its contacts are not designed for such duty and would soon deteriorate just as do those of the wall outlet receptacle (when plugged in under load). The contacts of a motor controller are designed for thousands of "makes and breaks" without serious damage under normal conditions.

Here again we must issue a warning. When we say "thousands of makes and breaks" we mean at infrequent intervals over a period of months or years; not 120 times an hour as in the case of the 20-hp motor we described previously. Every time the controller is opened the contacts will be heated and naturally (with frequent stops and starts of a normal cross-the-line-start motor) they are going to be overheated and start drawing metal up into craters and points (shaped like icicles.) The next step is the welding together of one pair of contacts as these rough protrusions try to carry the current that the whole contact surface was supposed to carry.

With one pair of contacts welded, we lose control of the motor. In the still rarer welding of the contacts in two phases, the motor continues to run single phase and may burn up if someone doesn't discover it in time and pull its branch circuit disconnect.

We have been talking about the normal cross-the-line magnetic starter with copper contacts (usually silverplated or otherwise treated for better surface conductivity under corrosive conditions). The starter manufacturers can provide controllers with contacts made of other metals suitable for frequent starts and stops. Any designer who really wants to do a job should provide contacts for any automatic or frequently started load.

Whether it is an air compressor, refrigeration compressor, float controlled or pressure controlled water pump, etc., malfunction of its automatic cycling device or improper maintenance of filter pads, condenser grills, water strainers, etc., may bring on unexpected recycling at unreasonable intervals. Owners or operators are not aware that such unnormal recycling is dangerous, or even runs up unnecessarily large power bills at the meter, till a final breakdown or mishap brings a rude awakening to the facts. And, even then, the service man may thoroughly confuse the issue with poor explanations of cause, not an uncommon situation, unfortunately.

Forty years ago, all starters were of the manual type, whether for d-c or a-c. With the change over to a-c and the advent of the cross-the-line-start motor, the magnetic (remote control) starter came into popularity and today a so-called manual starter is becoming a rarity on any motor over 5 hp.

You may class the drum-controller (for variable speed operations) as a manual starter but usually they are coordinated with magnetic reversing and make-up contactors, if the motor is to be reversed. These magnetics are necessary where limit switches, "dead-man" pedals or other such devices are desired in a control circuit.

We speak of a manual starter (in catalogs and descriptive literature) as one where all controls, such as push buttons, levers, pull chains, etc., are built in to the one enclosure. But, actually, the remote control class of starters (known by the electricians as "mags") are manual starters in the average application. They are manual, where controlled solely by remote push-button stations, or they may be automatic, where they are actuated entirely by limit switches, pressure switches, float switches, or what have you, in the holding coil circuit.

Then there are the completely automatic devices such as pressure switches on air compressors or refrigeration machines, thermostatic controllers, etc., which present no means of operation by man. These devices are built in to unitized equipment by the manufacturer-designer and have the necessary contacts for insertion in the motor leads. We will refer to them as "fully automatic controllers" in contrast to the "remote control" (magnetic) starter.

And finally we have the complex assemblies of contactors, relays, timing (clock) motors, rheostats, etc., which make up one remote controlled or automatic starter for complex motors such as slip-ring, synchronous, multi-winding speed

changing, d-c printing press, rolling mill, etc.

There is little that needs to be said about controllers in this article. They either work or they don't work and the results are obvious. The proper controller for any type of motor can be prescribed by the motor applications engineer. But, once more: we must caution about obtaining the proper-type contacts in your controller, where frequent starting and stopping is an item.

Here, again, it may be well to point out that the control equipment we are talking about is intended to take the place of stand-by employees or provide greater precision and you get just what you pay for. Nothing but the best and most dependable should be considered. In most cases, the first cost of any electrical equipment doesn't begin to compare with the long-term payroll expense of the employees it is intended to relieve. To try to cut any corners in its installation is just plain asinine (if we may be permitted such a strong word.)

Today, the loss of production during down time and the added expense of extra maintenance personnel and replacement parts will not justify any pennywise bargaining. But, as we pointed out at the first of this series: **Tomorrow**—it will be impossible. To try to associate an automation setup with inferior or mis-applied drive components will be like trying to couple a man's brain to a jelly fish. Ask the people that fire these guided missiles.

Visibility up and down the streets and around homes makes for street safety

CHILDREN SAFE UNDER NEW STREET CODE

First job in the first county to adopt the American Standard Practice for Street and Highway Lighting, approved by the American Standards Assn., was recently completed to everyone's satisfaction in Cheviot Hills subdivision in Sacramento County near McClelland Field. The installation was made by Lupen & Hawley for the county lighting district formed by the property owners of the subdivision, headed by Milo F. Thompson. The citizens' group asked the supervisors for the lighting to provide street safety at night for their children who might play in the streets and be seen adequately by all drivers of cars.

Sacramento County adopted the Illuminating Engineering Society's standards after they had been approved by the ASA. It means that any future street lighting in the county must equal the requirements or exceed them, whether on residential or business streets. William F. Pillsbury, division engineer, utilities division, and Henry Hampton of the county public works engineering staff recommended the standards to A. L. Kiefer, director of public works.

The Cheviot Hills installation consists of 36 G-E incandescent luminaires on 25-ft steel poles located to distribute illumination evenly. Depending on location at intersection, cul-de-sac or straight-way lamps are either 4,000 or 6,000 lumens and spacing varies with street conditions but averages 185 ft staggered. The circuits are run underground.

Radiant glass panels suspended from porch rafters provide comfort for spring and fall

THE PATIO —

Heat Sales Opportunity

A contractor's market for electric heat is not limited to indoors, it is being shown in the Seattle area. An unheated patio is not usable there much before June or after August, and electricity provides the simplest means to heat it. In the Charles Peterson home, Seattle, eight Rumar 1-kw radiant glass units, 11x46 in., 22 in. deep, are mounted, some overhead at an angle as shown, some not over 24 in. from the floor, according to Paul Heydon, sales manager. With a 1.2¢ rate from either Seattle City Light or Puget Sound Power & Light the patio is heated for 9.6¢ an hour. Installation cost was about $700, a good job for the contractor. Patios near swimming pools are especially good places to sell and install radiant electric heat.

Interested Throngs Crowd Sacramento Trade Show

All 38 exhibits were kept busy showing and explaining new electrical products

Everyone pitched in as the pioneers of tradition did in Sacramento to make the very first "Progress in Electrical Equipment Exhibit" of the Sacramento Valley Electrical League's Electrical Construction Section at Sacramento Inn, March 8-10, a whopping success. It certainly was, and the 38 manufacturers and agents displaying in it felt it was in every respect.

Not a public show but open to the electrical industry and its commercial and industrial customers by invitation, the 38 displays encompassed electrical equipment, wiring materials, apparatus, lighting, heat pumps and control equipment.

Attendance far exceeded expectations, although the widespread direct mail program announcing it aimed at such a response. The three-night, two-day show was attended by 2,140 people, each one a prime prospect. Particularly interesting was that 20% of the attendance was from outside the metropolitan Sacramento area and registration cards showed they came from as far as Redding on the north to Fresno on the south.

The response from the electrical trade was attributed to the cooperative industry effort through the show committee. It was headed by William Hagen of Zinsco Products and was composed of manufacturers' representatives, distributors, electrical contractors and Sacramento Municipal Utility representatives. Members of the committee contacted distributors and contractors throughout the area, set up display cards on city counters and distributed invitations.

The show staff, Clarence Epling of SMUD and Harry O'Laughlin, the league secretary-treasurer, was responsible for the general show operation and the direct-mail program that brought out the crowds.

LUMINOUS CEILING DISPLAY HELPS SELL

Always a firm believer in advertising its services, California Electric Works, San Diego, makes every foot of its space work for it, be it ceiling or floor. How it has managed to pack so much in so little space has always been somewhat of a miracle. But, likewise, this sales-minded electrical contracting company knows that the buyer is best sold by being made to see what he is buying. Lighting can do that. The same idea holds true of lighting equipment itself. How show it as well as what it does?

The ingenious solution at Calewo is a combination one. The display of the variety of types of luminous ceiling panels and materials is placed strategically right over the service counter area where customers come to buy everything else. And everything else is well displayed there so the high-level illumination provided by the luminous ceiling display makes it all easy to see.

Other applications of good lighting are used in all departments and offices and likewise provide actual demonstrations of what they sell. This counter area, however, is the most active sales area.

According to Norman Ferguson, president, the company is planning to move sometime soon into a large new building of its own where more applications of all things electrical will be used for display as well as efficiency. The company has outgrown its compact quarters and already occupies several additional buildings for warehousing and equipment housing. The new plant will be something to see, for it will not only be designed for maximum work efficiency but, like Ferguson's own all-electric home, it will be designed to sell electrical progress.

Samples of every type of ceiling lighting panel over the sales counter at Calewo

When poles and palms don't mix...

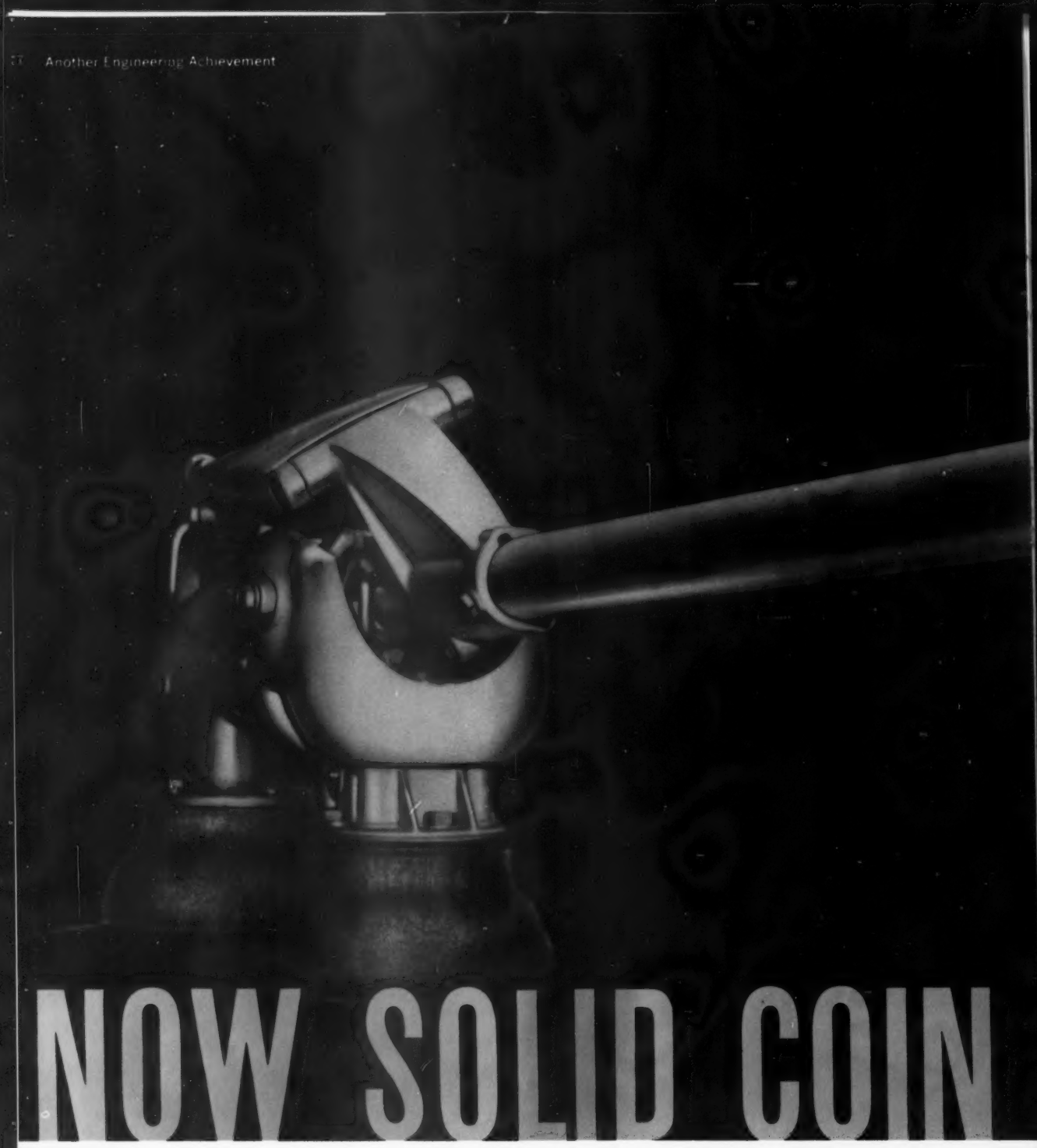
No poles or overhead wires will mar the beauty of Arvida's Royal Palm Yacht & Country Club residential community! With 742 homesites, this distinguished Boca Raton, Florida community is putting *all utilities underground*. For the job Arvida selected Orangeburg Fibre Conduit—the best known, best-selling Brand in America. And for good reasons: Orangeburg Conduit is lightweight, easy to install. Its self-sealing joints and impermeable walls keep water out for good. Its 100% smooth fibre raceway adds years to cable life. Get all the facts on Orangeburg Fibre Conduit. Write Dept. WE-50 for Catalog 52.

Architect's drawing – Arvida home of Dr. and Mrs. John F. Pearl. Architect: Arthur H. Rude, of Ft. Lauderdale.

ORANGEBURG® FLINTKOTE
Fibre Conduit

Orangeburg Fibre Conduit is distributed by Graybar Electric Co. and General Electric Supply Company with branches and stocks in principal cities.
ORANGEBURG MANUFACTURING CO., Orangeburg, New York. Division of The Flintkote Company, Manufacturer of America's Broadest Line of Building Materials.

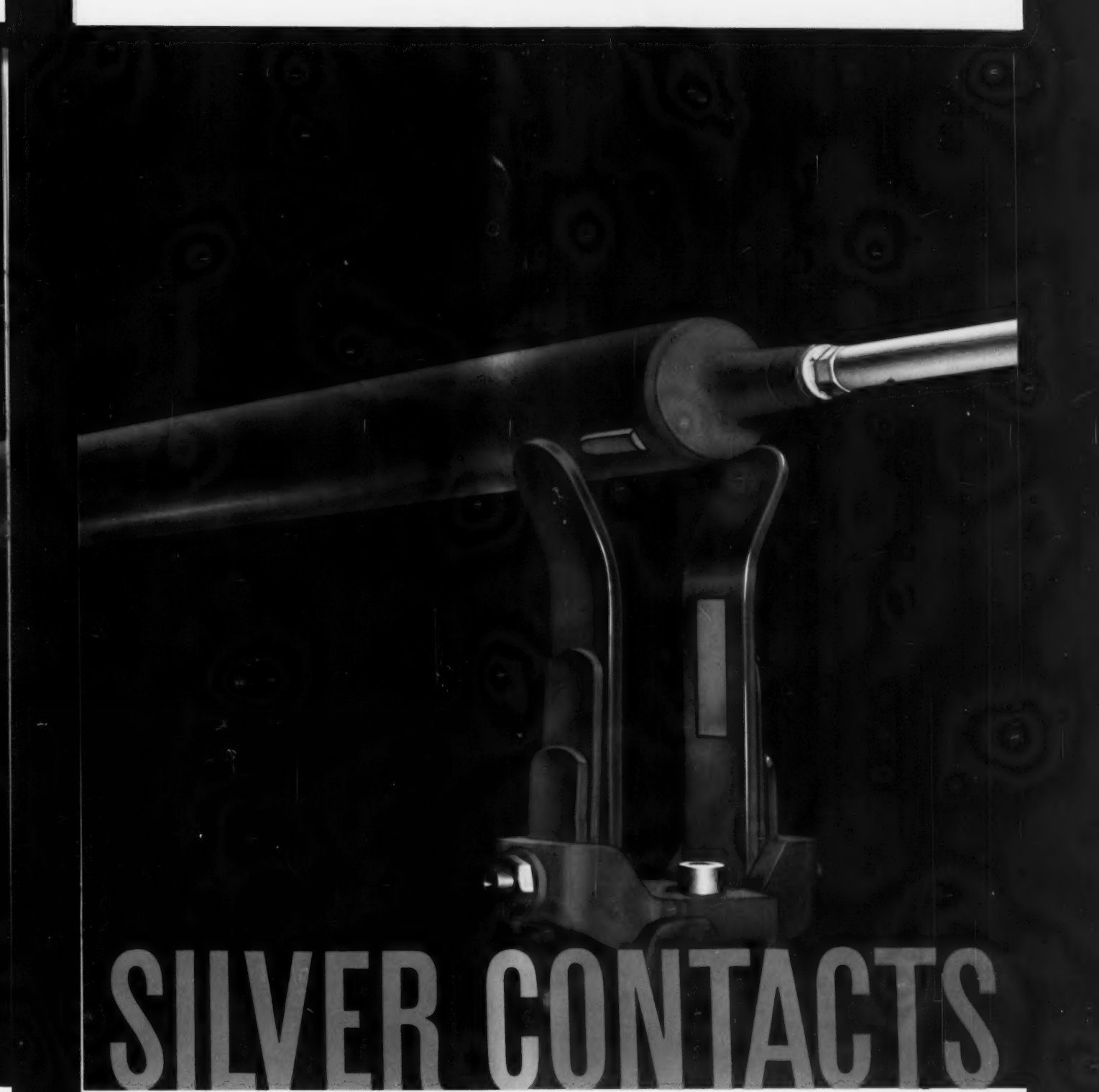
27 Another Engineering Achievement



NOW SOLID COIN

FROM FEDERAL PACIFIC...NEW HIGH PRESSURE CONTACTS

HIGH PRESSURE CONTACT with no galling action at the contact areas! Federal Pacific's rugged new Air Disconnect Switches use integral, solid coin silver inserts that are harder than the hard-drawn copper. Permits heavy wiping action assuring thorough cleaning, more consistent low contact-resistance, ability to withstand high momentaries. Eliminates corrosion under adverse atmospheric conditions.
ANOTHER FEDERAL PACIFIC FIRST. This revolutionary design gives you a complete line of Air Disconnect Switches with longer, maintenance-free life. Eliminates the need for multiple, parallel contacts. Available on TG & YVH group-operated switches. Vertical break types: 7.5—34.5 kv (400, 600, and 1200 amp) and 46—330 kv (600, 1200 and 1600 amp) and center side break types: 46—161 kv (600 and 1200 amp). Over 50 years experience in design and manufacture of power switches for utilities helped bring forth this new development.
SPECIAL LABORATORY TEST APPARATUS designed to study galling phenomena, the first of its type—was created by Federal Pacific to duplicate switch closing action and



FOR AIR SWITCHES...HARDER THAN HARD-DRAWN COPPER

record variations in coefficient of friction at contact. Result: the first high pressure, maintenance-free solid silver to solid silver contacts that will not gall!

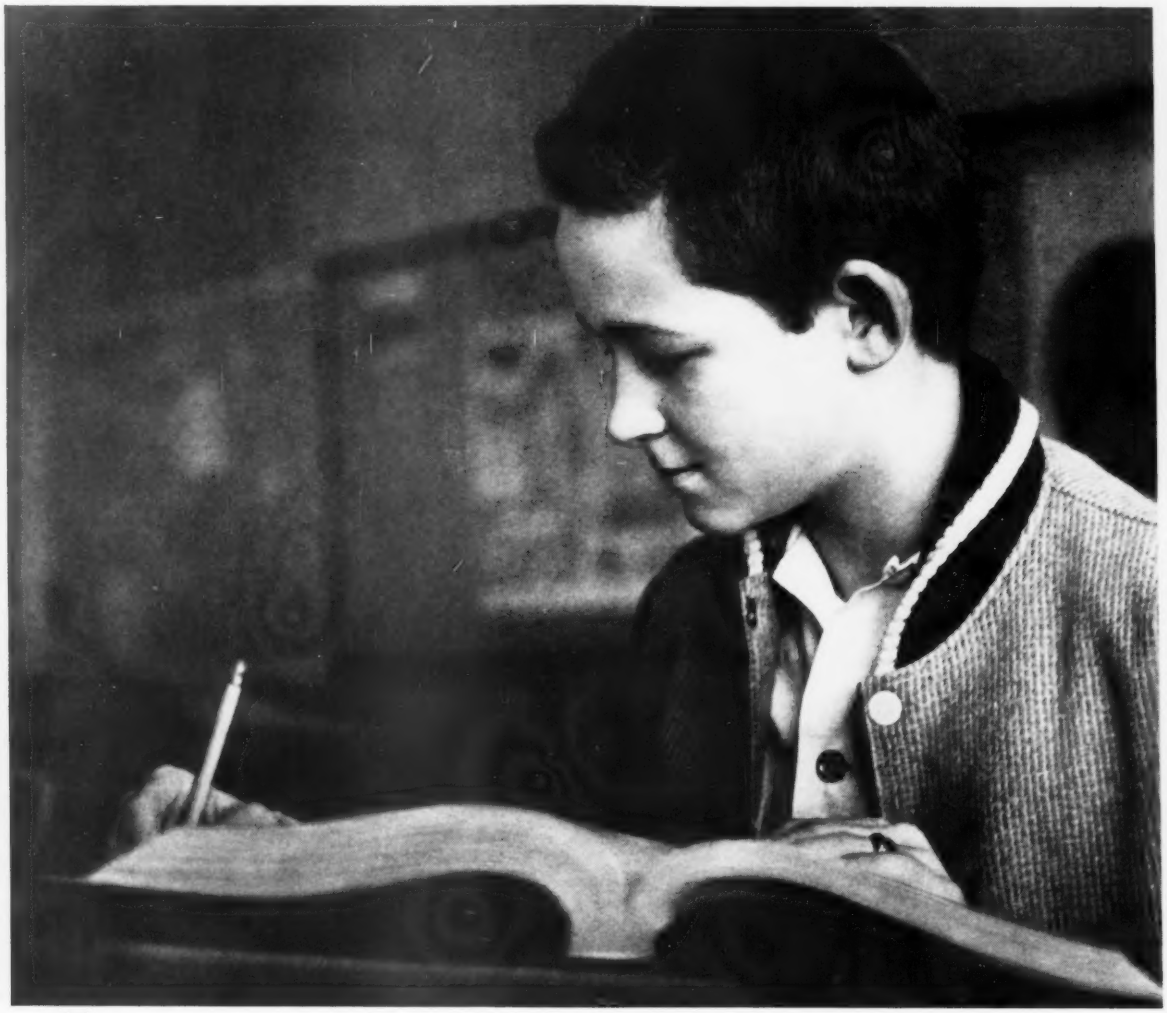
Additional information on the new Federal Pacific Air Disconnect Switches with harder, non-galling, solid coin silver to solid silver contacts may be obtained from your local Federal Pacific Electric Representative, or by writing to Federal Pacific Electric Company, General Offices: Dept. 388, Newark 1, New Jersey—The Best in Electrical Control, Distribution and Power Equipment.

FPE **FEDERAL PACIFIC ELECTRIC COMPANY**

Affiliated with Cornell-Dubilier Electric Corporation

with longer, maintenance-free life. Eliminates the need for by Federal Pacific to duplicate switch closing action and

Q. *What have heat pumps done for this school?*

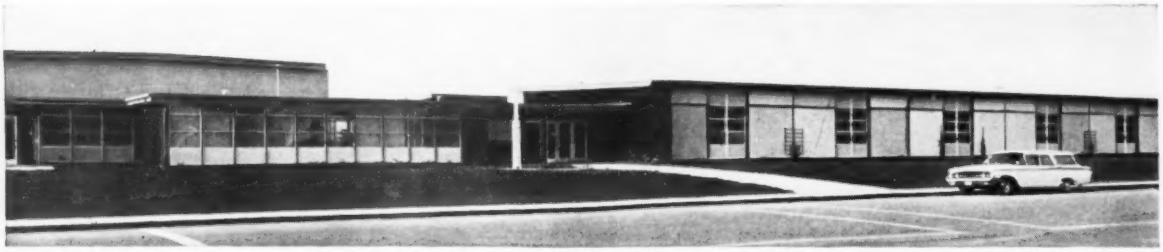


A. *Provided heating and air conditioning at the lowest possible cost!* A single heat pump in each classroom solved the air conditioning problems at Barrett School, San Lorenzo, California! At low cost, heat pumps keep rooms warm *or cool* as the weather demands. Heat pumps are installed on corridor roofs, taking up no classroom space, making future building expansion easy. Result: a modern, flexible system. More information on efficient, practical heat pumps for schools and commercial buildings is available on request. See your air conditioning dealer or call your local PG&E office.

PG&E Service is your best bargain

P·G and E·

Pacific Gas and Electric Company



FPE
Affiliated with Cornell-Dubilier Electric Corporation

Manufacturers—Distributors

Westinghouse stockholders had a chance to talk with President Mark W. Cresap following their meeting in San Francisco

Dr. John A. Hutcheson, vice-president in charge of engineering, told of company pioneering in molecular electronics

Westinghouse Stockholders Meet in San Francisco

Westinghouse expects to spend between $65 and $75 million annually for the next five years to maintain and expand its facilities, President Mark W. Cresap told stockholders at the company's 74th annual meeting held in San Francisco last month. Though vigorous, expansion is selective, he said, and consistent with profitable growth.

Emphasis on current profit performance will not be at the expense of programs vital to the company's future growth, he said, citing the fact that more money was spent in 1959 than ever before on basic and fundamental research, long range development programs for manufacturing equipment and processes and on studying future market trends.

Commenting on activities in the West, Cresap said that operations have been expanded to include facilities and offices in 40 locations with an annual pay roll in excess of $43 million. He said that the Sunnyvale plant is the largest electrical manufacturing operation west of the Mississippi and is one of three company plants now undergoing a multi-million-dollar modernization.

He also pointed to the atomic engine at the Naval Reactor Facility at Arco, Idaho, which he described as one of the company's most difficult engineering tasks and proudest achievements.

Westinghouse is now engaged in reactor development on five commercial atomic power projects with a total capacity of more than 300,000 kw, he said, and has offered to build a 330,000-kw atomic power plant that would be capable of producing competitive electric power in high fuel cost areas.

At a press conference following the meeting, he said that sales are running 5 to 10% ahead of the 1959 rate. Sales of heavy equipment for the first two months of the year were slightly below expectations but are expected to show predicted gains for the 12 months, he said.

This was the company's second stockholders' meeting in the West. The 1954 meeting was in Sunnyvale, Calif.

► **Jet Line Gun** has changed its name to Jet Line Products Inc. Western representatives are: Lippincott Co., San Francisco, Los Angeles and Salt Lake City; Ralph L. Millie, Denver; Vernon B. Cobb, Seattle.

► Under a consent decree filed in the U. S. District Court at Chicago, **ESCO** Mfg. Co. was enjoined from infringing on **G&W Electric** Specialty Co.'s copyrights and from unfair competition by use in its advertising or literature information taken from G&W copyrighted books.

► **Ace Electric Co.** of Eugene, Ore., a subsidiary of the Portland firm, opened a new office at 2475 Hilyard St. recently. **John Hendrix,** formerly with Clarke Electric Co. of Eugene, is manager.

► **Owen Nicholson** was recently appointed manager of Anaconda Wire & Cable Co.'s new district in Phoenix, which will be opened May 1.

► **Rapid Electric Service,** Glendale, Calif., has announced that it is doing electrical engineering of building and industrial plants as well as making quantity surveys and takeoffs of any engineered electrical work. The firm recently appointed **H. J. Stein** as chief engineer. Stein has been in the electrical construction field for more than 20 years and has had extensive experience in the design of specialized test equipment.

► **W. E. "Bill" Earl** Sr. was in Honolulu in late March and early April to open a new branch office of **Don H. Burcham** Co. The Portland manufacturer's representative firm also has a branch in Seattle. **Arthur "Boyd" Christopherson** Jr., formerly with Lay & Nord, Yakima distributor, will manage the Honolulu branch.

► A monthly rental plan for a desktop analog computer designed for use by electrical utilities, university engineering departments and consulting firms for analyzing transmission problems and calculating power-system designs has been announced by the **General Electric** Co. G-E's computer department at Phoenix, Ariz., said a five-year lease plan for the $8,600 unit would figure approximately $180 a month. George Hagerty, manager of marketing for the division, said the plan is the first step in an overall leasing program of G-E industrial computers.

► **W. W. Wallace,** recently promoted from general manager to executive vice-president of **Wright-Temp** Mfg. Co. of Phoenix, has appointed **R. L. Swearingen** as West Coast sales engineer. Wright-Temp products include a heat pump and refrigerated air conditioning line.

Forty Years Old

Celebrating its 40th anniversary, Scott-Buttner Electric Co. opened a new office building in Oakland at 896 Isabella St. Formed in 1920, this electrical contracting firm has grown from a two-man operation to a business employing a field force of 125, backed by 18 engineers and office workers.

Offices are located in Oakland, Mountain View and San Francisco, where its affiliate is Golden Gate Electric Co. Edgar L. Buttner is president; Edgar M. Buttner, vice-president. Managers are Loren D. Nutter, Oakland; George E. Clyne, Golden Gate Electric Co.; Edwin P. Schlinger, Mountain View.

INDUCTIVE PICK-UP

IN INSULATOR'S CLOTHING

This is a current-sensitive pick-up* whose looks may be deceiving: the "package" is a post-type insulator, but buried in it is an inductive pick-up coil. For every 60 amps flowing in the conductor, one volt is induced in the coil—and the relationship is *linear*, within a few percent, up to 5000 amperes. Furthermore, the voltage bears a fixed phase relationship to the conductor current.

We could offer this as a "standard product" (in fact, you can order one or a hundred right now, if you like), but it seems better to tell you how it works and then hope you'll tell *us* what you want to do with it. You can use it to feed a vacuum tube or transistor controlling circuit, one or more relays, a magnetic amplifier, panel instrument and other "black boxes". Here, a few possibilities — some of them ideas, others actual applications: capacitor switching on the basis of phase angle or current; load limit tripping, checking or warning; built-in means of measuring line current; power direction sensing. No matter how you use it, this pick-up offers several possible advantages to you: low first cost and installation economies, safety, convenience, elimination of hot sticks and dead-ending . . . .

Some of these devices have been installed in the field along with the appropriate black boxes. We even have a few of these boxes all made up, and can build more. If you have an idea about how you'd like to use this pick-up, we'd certainly like to hear from you. The Fisher-Pierce Co., 43 Pearl St., So. Braintree 85, Mass.

*Pat. Pending

FP

FISHER PIERCE

PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

► **Pacific Wholesale Electric** Co., which expanded into a large new building in San Diego last year, now announces a new branch at 1194 N. Johnson Ave., E. Cajon, according to Ralph Rohrbach and Kenneth Lyons, owners of the electrical construction supply distributorship.

► **Anaconda Wire & Cable** Co. has formed a new branch of service, the ADES program—Anaconda Defense-Electronics Service. The program is designed to provide customers with technical engineering help and commercial services on their wire and cable needs. Headquarters will be at 2201 Bay Road, Redwood City, Calif., site of Sequoia Wire & Cable Co., an Anaconda subsidiary.

► **American Factors** has taken over the electrical department of **Kauai Commercial** Co., Port Allen, Hawaii, and will operate it as a branch of its machinery and electrical department.

► Establishment of a San Diego area resident office by **General Controls** Co. has been announced by J. F. Ray, vice-president in charge of sales. The new branch is located at 4750 Seminole Drive. Because of nearby Glendale manufacturing and warehouse facilities, no local inventories will be maintained at San Diego for the time being.

► **J. H. Pomeroy** & Co. has moved its engineering division headquarters from Los Angeles to San Francisco. Heads of the division's civil, electrical mechanical and architectural design departments have been moved to new offices in the Pomeroy Building at Sansome and Pacific Streets in San Francisco.

► A new conduit company is headed by R. C. Bennett Jr. and T. J. Kavanagh, president of Wheatland Tube Co. Headquartered in Pittsburgh, it will be called **Wheatland Electric Products Co.** and will market its own line of standard and specially designed electrical products through distributors. Bennett, former vice-president of National Electric Products Corp. and then of Bennett Associates Inc. until it was taken over by H. K. Porter Co., has associated with himself F. J. O'Reilly, former vice-president of manufacturing of NEPC, who will be vice-president and general manager. The line will include underfloor duct and headerduct systems as well as conduit, metallic tubing, made by Wheatland Tube Co.

► **Superior Electric** Co.'s mobile display trailer has been touring the West showing the company's new models of line voltage and light control equipment, its Stabiline automatic voltage regulators, Powerstat variable transformers, Luxtrol light controls, etc. It was a feature of the EMEA show in Los Angeles where it won first award for a fully operating display. The award was made by ELECTRICAL WEST from selections made by the Purchasing Agents Assn.

► **Wesley Evans** has been doubling the facilities of Salinas Electric Works, pioneer coast electrical contracting and industrial business. In addition to increased yard facilities for trucks and outdoor storage, a new building as large as the previous one is under construction for new offices and stock room. The entire old building will be also used for stock.

► **Acme Powerline Construction** Inc. is a new corporation established in Salt Lake City for construction of transmission and power lines and industrial installations with **C. Allen Elggren,** president; **Richard H. Moffat,** vice-president, of Salt Lake City; and **Duane B. Welling,** secretary, Bountiful.

► **Powerdyne** Inc. has appointed **Matzinger-Johnson** Co. as its sales representative for southern California, Arizona and Clark County, Nev. The company manufactures high voltage switch gear.

► **Auth Electric** Co. Inc. of Long Island, N.Y., maker of electrical signaling systems, held its Western regional sales conference at the Brown Palace, Denver, April 4 and 5. Representatives from the western half of the United States gathered to hear Gordon Auth, sales vice-president, and John Dugan, general sales manager, outline the company's program.

► **Wayne C. Wells** Co., 6055 N. E. Glisan St., Portland, has added Metaltite Products Co. Inc. line of JIC boxes, wiring troughs, enclosure panels and oil and open wireways to the lines it represents. Wells will represent the Oak Park, Ill., factory in Oregon, Washington and Alaska.

► The **General Electric Computer Department** in Phoenix, Ariz., has announced three top managerial appointments: **Kenneth R. Geiser,** former manager of engineering, as manager of the department's newly organized business-planning operation; **Dr. Robert R. Johnson,** former manager of the department's computer laboratory at Palo Alto, Calif., manager of engineering; **Dr. Helmut M. Sassenfeld,** former manager of operations for the department's Huntsville, Ala., computer center, manager of a new applications section.

► **Dr. Chauncey Starr,** general manager of North American Aviation's **Atomics International** Division, has been made division president. Headquarters are at Canoga Park, Calif.

► In a move to diversify into nonmilitary manufacturing **Missile Systems** Corp., Los Angeles, has entered the lighting fixture business. The firm has acquired Universal Fabricating Corp., Pennsauken, N. J., which makes fixtures for industrial, commercial and residential use.

► Donald A. Dunn has been named director of the newly formed **Research Division of Eitel-McCullough** Inc., San Carlos, Calif. Dunn joined Eimac in 1959 as manager of the Supporting Research Group. The new division, consolidating many Eimac research activities, will contribute new technical knowledge to the product development programs of Eimac and its subsidiaries.

► **California Wholesale Electric,** Los Angeles, added the Auto-Call line as of March 1. Auto-Call is a producer of paging and signaling devices.

► **Breezee Supply** Co. of Portland has been appointed a general distributor for industrial rubber products made by **United States Rubber** Co. **Robert Mickelson** is president of Breezee which is located at 3321 N.W. Yeon Ave.

► **Kyle Langston** has been named manufacturer's representative in southern California for **Electro-Ray** Mfg. Co., Seattle, maker of electric baseboard heaters. Electro-Ray produces self-contained units in lengths from 2 to 12 ft, ranging in wattage from 500 to 4,000. Langston's headquarters are at 7514½ E. Newmark Ave., South San Gabriel.

► **H. T. "Chief" Dutter,** Dutter & Associates, Los Angeles, who has been handling the **Day-Brite Lighting** product line exclusively, is now seeking to expand service and personnel by adding other lines. Dutter, who took over the Day-Brite line Jan. 1 when the company switched over from a branch office operation, covers five counties in southern California.

NEW KLEIN CATALOG

Here is the 1960 edition of the Klein catalog illustrating and describing the complete line of Klein tools and equipment for electricians.

It contains many new additions to the Klein line—including Replaceable Gaff Climbers, a newly developed Hot Line Grip and an even wider range of pliers for every purpose.

The Klein Catalog 103 will be of interest to linemen, electricians —good workmen everywhere.

Write for yours.

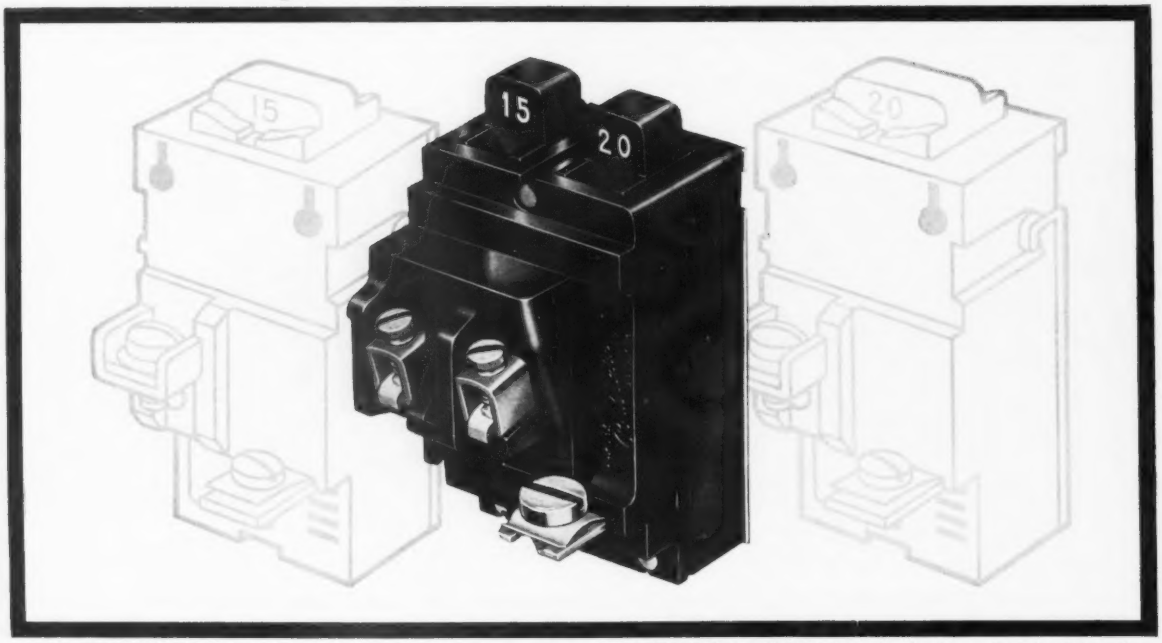
Foreign Distributor: International Standard Electric Corp., New York.

Mathias Established 1857 KLEIN & Sons Chicago, Ill., U.S.A.
1200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

BullDog's

NEW DUPLEX

The only space-saving breaker



1. SPACESAVER. New Duplex Pushmatic® breaker puts two breakers in the space of one single breaker. You get more electrical circuit flexibility with smaller panels; and 15- and 20-amp capacity, in any combination.

2. DOUBLE PROTECTION. Duplex is the only 2-in-1 breaker that gives coil-magnetic short-circuit protection, as well as thermal overload protection, for each circuit. Provides identical, independent coil protection in each pole.

Consult the following Pacific Coast representatives:

Coast Electric & Manufacturing Co.
1733 N. E. Seventh Ave., P. O. Box 7866
Portland 12, Oregon

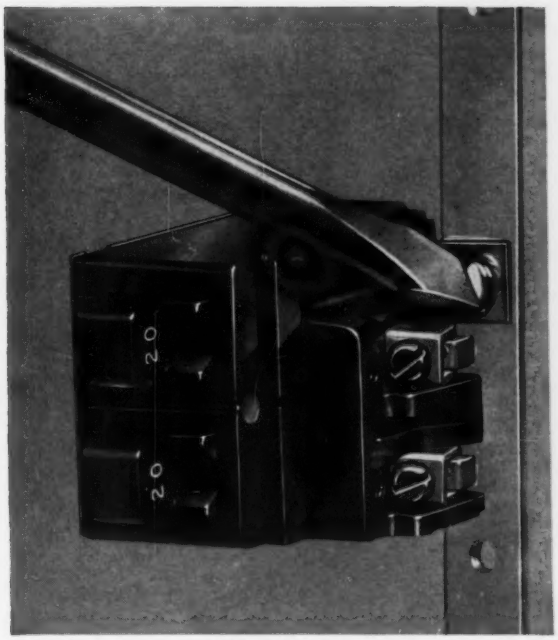
Young Electric & Mfg. Co.
2134 Curtis St.
Denver 2, Colorado

Safety Switchboard Company
910-89th Avenue
Oakland 21, California

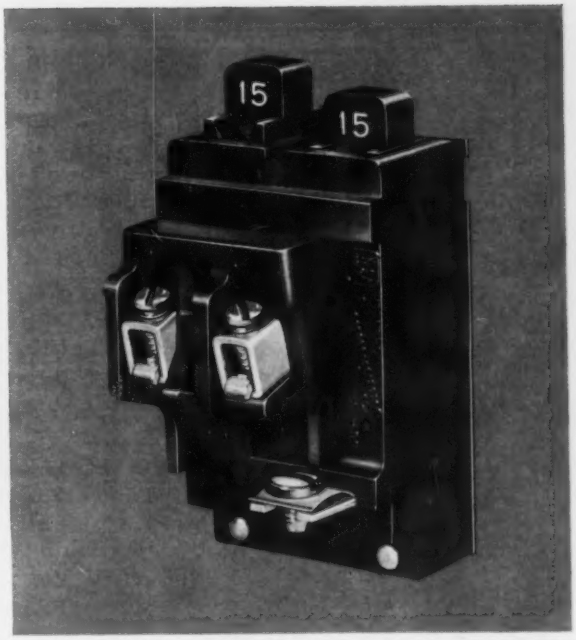
BullDog Elec. Prod. Co. of Los Angeles
2885 E. Washington Blvd.
Los Angeles 23, California

PUSHMATIC!

with coil-magnetic protection!



3. ONE BOLTED CONNECTION. Duplex provides a single positive bolted connection to bus bar. Electrical contact is under constant pressure, won't work loose, won't overheat. Installation is quick and easy.



4. PUSHBUTTON CONVENIENCE. Only Duplex Pushmatic has pushbutton convenience. Pushbutton pops up, can be identified instantly by sight or touch. You reset it with a push of the finger. Simple, fast, foolproof!

BullDog Electric Products Division, I-T-E Circuit Breaker Company,
Box 177, Detroit 32, Michigan. In Canada: 80 Clayson Rd., Toronto, Ont.
Export Division: 13 East 40th St., New York 16, N. Y.

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY

COMPACT... ADAPTABLE... RELIABLE

New Westinghouse Isolated Phase Bus

Ever-increasing current and voltage ratings . . . maximum in compact arrangement . . . full adaptability to generating and distribution station layouts . . . complete reliability—these are the modern station demands met by new Westinghouse isolated phase bus. Here are the design features which assure long, trouble-free performance:

Single Insulator. Only one high-strength insulator is used at each bus support location. Deep grooves provide high dew withstand voltage. Resilient mounting reduces short circuit forces on the porcelain. All combine to provide maximum reliability of service.

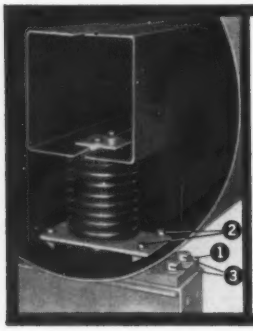
Main Conductor. Hollow square or tubular bus may be specified to suit application requirements.

Enclosure Construction. Enclosures are cylindrical; of heavy, heat-treated aluminum plate; rolled and seam-welded . . . assuring maximum strength against internal or external pressure and side stress. Enclosure tightness is assured.

Accessibility of Enclosures. Telescoping of enclosures simplifies inspection and maintenance of insulators and conductor joints. Adequate clearance facilitates telescoping and alignment. Longitudinal gaskets are eliminated. Circular, extruded, neoprene gaskets, retained by two-bolt clamping rings, make assembly easy and assure tight joints. Enclosure ends are not flanged. Small supporting feet reduce weight and provide smooth cylindrical exterior.

Coordinated Design. Westinghouse isolated phase bus is coordinated in design to assure long, economical service with minimum maintenance—and to reduce field assembly time by permitting large assembly shipments, limited only by shipping and handling facilities.

For complete facts, call your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60998

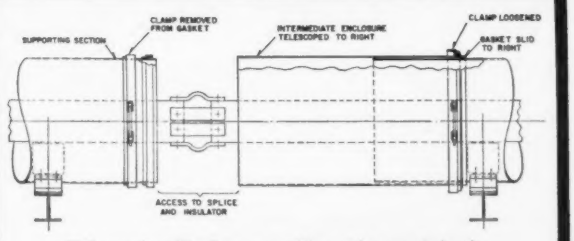


Only One Insulator Is Required at each main conductor and enclosure support location. Enclosure tightness is assured by these arrangements:

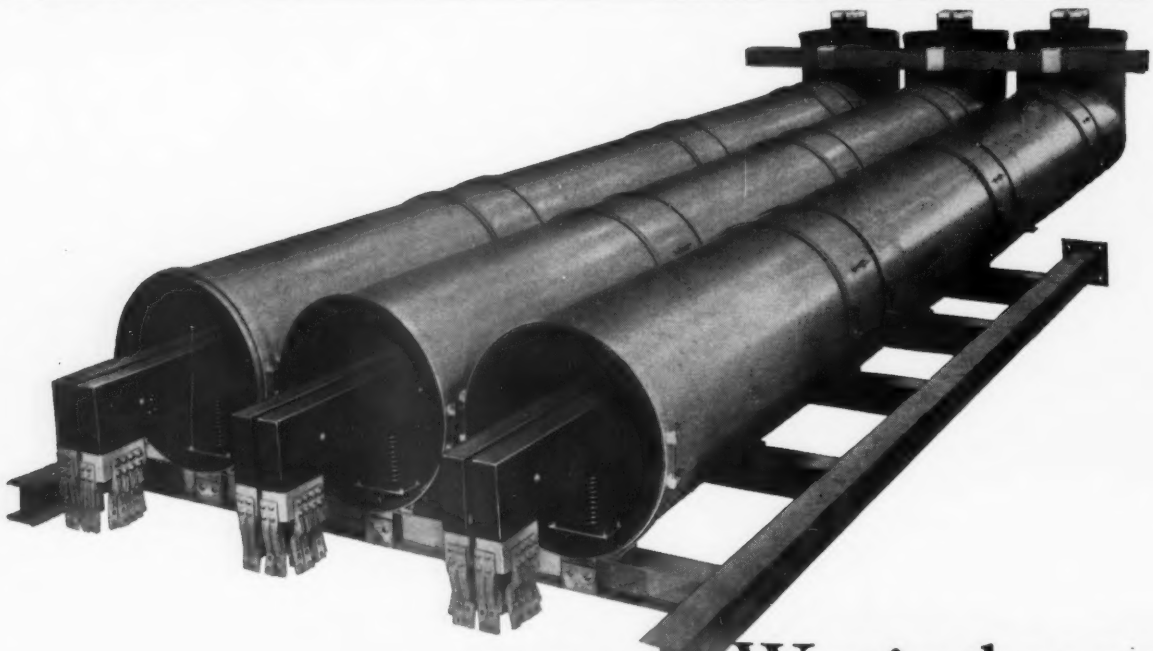
1 Welded-in support of high-strength extruded aluminum.

2 Resilient insulator mounting plate bolts dead-end in extruded support.

3 Assembly mounting bolts are external to the enclosure.



Telescoping Enclosure provides ready access to insulators and conductor joints for inspection or maintenance.



YOU CAN BE SURE... IF IT'S Westinghouse

For phone number of closest representative see advertising index in back of book.

Associations

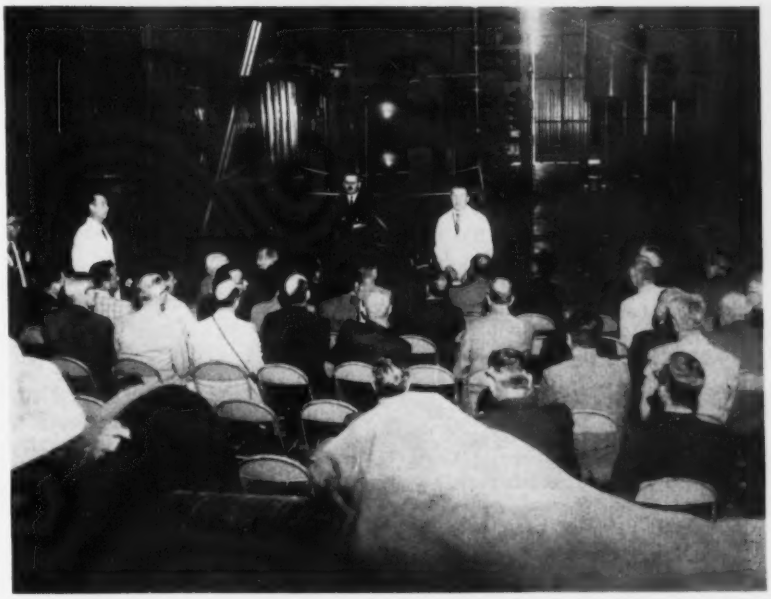
► **Northern California Chapter, NECA,** with its three branches, recently completed election of new officers, placing George Curran, Red Top Electric Co. and former Alameda Branch Chapter, as president of the chapter. Robert J. Ingersol, Newberry Electric Co., Richmond, is vice-president; Jack Ellis of Vallejo, treasurer; and Walter Vance, California Electric Co., Oakland, governor. Heading the branches are: E. M. "Ted" Buttner, Scott-Buttner Electric, chairman, Alameda Branch; Steve Lindheim, Schwartz & Lindheim, vice-chairman. At the Solano-Napa Branch Harold Pierce, Vallejo, is chairman; and Jack Ellis, vice-chairman. Of the Contra Costa Branch Robert Ingersol is chairman and C. M. Hegstrom of Rodeo vice-chairman. Matt Gallagher is the chapter manager and Robert R. Gonzales is the newly appointed assistant chapter manager.

► **Oregon PUD Directors Assn.** elected its new officers: Archie Pye, Tillamook PUD, president; Forrest A. Albright, Central Lincoln PUD, first vice-president; J. D. Puzey, Clatskanie PUD, second vice-president; and Cecil Byers, Northern Wasco PUD, secretary-treasurer.

► The **San Francisco Bid Depository** office has moved from the former A. E. Rowe Co. office on Mission Street to Room 429 at Merchandise Mart Bldg., 1355 Market St., and has a new phone number, MA 1-4312. Bids are now deposited at the Bank of America rather than at the depository office. **John R. McManus** is custodian.

► **Charles Scholibo,** NECA director of the Western Region, recovered from a serious operation, was back in his San Francisco office early in April.

► **Intermountain Chapter,** NECA, was the first in the West to take on a "Self-Appraisal Workshop" for its Utah and Idaho members. A. R. Woolley, manager, announced locations of the two workshops to be Salt Lake City April 11 and 12, and Twin Falls April 14 and 15. They were open to both NECA members and nonmembers and ran from 3 p.m. through a dinner to 10:30 p.m. the first day and from 9 a.m. to 4 p.m. the second day.



It was a big day for the Northern California Chapter, International Association of Electrical Inspectors, March 16. It met at the Underwriters' Laboratories in Santa Clara for its business session, honored its past secretary, M. Kennedy Bliss, with a gift for his boat in thanks for his long service, at the noon luncheon as guests of the Santa Clara-San Benito Chapter, NECA, and was provided high-voltage fireworks as guests of Federal Pacific Electric Co. at its new testing facility in Santa Clara

► The second annual **Electrical Products Show,** presented by the **Electric Club** of San Fernando Valley was scheduled at Carpenter Hall Building, Van Nuys Boulevard, Van Nuys, for April 19 from 2 to 10 p.m. Some 50 manufacturers of equipment showed their wares. Jack Crabtree was chairman of the show.

► The 12th, and perhaps the last, series of seven weekly classes on Sales Promotion and Lighting Design, sponsored by the lighting industry of southern California through the **Certified Lighting Assn.** and conducted by **Roy H. Kreyser,** Los Angeles Department of Water & Power, began April 20 and runs through June 8. Meetings are held in the Boylston Street conference room of the department, with a class limited to 40. Some 480 have already taken the course.

People

► In the death of **George M. Gadsby** on March 29, the electric light and power industry lost one of its most eloquent and forceful fighters for private enterprise. Even as his funeral was being held, stockholders of Utah Power & Light Co. of which he was board chairman and former president received a communication he had signed, telling of the company's offer to build the lines linking Glen Canyon and Flaming Gorge. Aged 73, death came without warning, of heart failure, to end a brilliant career both in the electrical industry and civic affairs in Utah. Born in Cleveland, at 20 he graduated with honors from Marietta College and later from MIT. He came to Salt Lake City from West Penn Power Co. to lead Utah Power & Light in 1929. As president of Edison Electric Institute in 1951-52, he was the industry's champion in fighting government invasion of power development.

► Advancement of **C. L. Leonard** to the newly created position of assistant construction engineer for California Electric Power Co. has been announced by **Carl C. Ernst,** president. He will assist **P. H. Yelton,** construction engineer, in the supervision of all general construction and right-of-way activities.

PSP&L Appointments

Puget Sound Power & Light Co. has made three organizational changes in its operating department and named two new local managers in its Northern Division.

Emmet P. Kelly, safety director, takes on added responsibilities as assistant manager of operations and coordinator of civil defense. An electrical engineer, he joined the company in 1929.

Kenneth L. Harvey, formerly supervisor of the meter department in the Central Division, is now supervisor of meters and transformers. Clifford G. Johns, formerly an assistant to the operating manager, has been appointed automotive fleet superintendent.

The new local managers are Ralph Conner, at Sedro Woolley and Lewis Yarbrough at Langley. Conner, sales supervisor in the Northern Division for the past five years, succeeds Harlan Martin, who takes on new duties in the Bellingham sales department. Yarbrough, formerly senior distribution engineer in Burlington, succeeds the late Winn Tuttle.

George Gadsby

► All U. S. **Bureau of Reclamation** hydro power facilities and transmission systems in Wyoming and western Nebraska are now under the direction of **Ralph D. Asbridge.** He has been named to succeed **R. M. Sensintaffar** as chief of the power division of the North Platte River projects. Sensintaffer was recently appointed project manager. A veteran of World War II, Asbridge is a 12-year employee of the bureau and earned an engineering degree from Purdue University.

► **J. Walter Nelson,** Beverly Hills, Calif., has been appointed sales manager for the Mobile Home Heating Division of **Ramco Mfg. & Engineering Co.** of Portland. Nelson previously was southern California representative for Electro-Ray Mfg. Co. At one time he owned and operated Nelson Food Products Inc.

► **C. W. "Charlie" Callow** has joined the underground division of Southern California Edison Co. He recently has been with Okonite and formerly was with Sacramento Municipal Utility District.

► **Arthur F. Ager,** assistant director of the southern California area for the State Public Utilities Commission, retired recently after 41 years of state service. He was in the PUC office in San Francisco from 1925 until 1933, when he was transferred to Los Angeles.

► **Dr. Richard C. Potter** has joined the Ramo-Wooldridge Division of Thompson Ramo Wooldridge Inc. as head of Technical Staff Development at Los Angeles.

BCE Staff Changes

Retirement of Clarence "Chubb" Arnott, B. C. Electric's superintendent of electric generating stations, was announced last month by J. H. Steede, vice-president and chief engineer. Arnott was in charge of BCE generating stations over the past decade, a period in which the company's electric generating capacity increased from about 300,000 kw to nearly a million kw. He joined B.C. Electric as a surveyor 35 years ago.

Ted Collins, who has been responsible for maintenance of electric transmission and distribution lines in service since 1954, will succeed Arnott.

Succeeding Collins as superintendent of transmission and distribution maintenance will be W. D. Gill, present superintendent of substations. William F. Jarrett, now coastal area operations manager with headquarters at Westview, will succeed Gill.

► Seattle City Light has appointed **Gene Lasater,** formerly manager of its West Seattle-White Center office, to the new position of distribution program coordinator. He will promote and coordinate City Light's newly established program for expanding its underground distribution system and improving the appearance of the overhead system.

► **Charles L. Cummons,** self-educated power house superintendent at The Dalles Dam project of the Army Engineers, has resigned to become chief of operations at the New York State Power Authority's Niagara Falls development. Cummons has been in charge of The Dalles power house since February 1957. His knowledge of electrical engineering comes from home study and correspondence courses. He was a power house operator for the California Oregon Power Co. before joining the Portland district of the Army Engineers.

► **Roy Vernstrom,** assistant general manager of Pacific Power & Light Co., is the 1960 president of the United Good Neighbors organization for Portland and Multnomah County. He was campaign chairman of the 1956 UGN drive and has been a member of the board of directors since.

► **Richard "Dick" McCosh,** electrical engineer, has left the system resources and power planning section of Pacific Power & Light Co. to join the engineering consulting firm of Ford, Bacon & Davis.

NEW CHANCE ALL ALUMINUM TAP CLAMPS FOR HEAVY DUTY ALUMINUM-TO-ALUMINUM TAPS IN HIGHLY CORROSIVE AREAS

CHANCE "P. C." CC TAP CLAMPS FOR COPPER-TO-COPPER TAPS

CHANCE "P. C." AGP TAP CLAMPS FOR BI-METAL CONNECTIONS OR "P. C." AA FOR ALUMINUM-TO-ALUMIINUM

THREE WAYS TO MAKE GOOD HOT LINE TAPS

The first step to making a good line connection is selecting the right and the best clamp for the type connection to be made—there's nothing profound about that—but there's something profound about the development of the product to meet the requirement. Chance engineers "dig much deeper"—go much further than you would probably think necessary to develop hot line clamps for various types of connections. Here are three examples of the best from their concentrated development work:

FOR ALUMINUM-TO-ALUMINUM HEAVY DUTY IN HIGH CORROSION AREAS. The new Chance All-Aluminum Heavy Duty Clamp is designed for use with the big conductors employed in today's farsighted construction projects. Except for one stainless steel pin, this husky clamp is made entirely of aluminum—ideal for aluminum-to-aluminum taps in areas where atmospheric contamination creates a problem with other clamps. Its complete compatibility with aluminum conductor prevents galvanic corrosion and also results in uniform thermal coefficients of expansion for maximum operating efficiency. A special "waved" main line contact gives good low resistance connections even on slightly oxidized conductors. The clamp handles conductors up to 397.5 MCM ACSR in both the main line and jumper terminals.

FOR COPPER-TO-COPPER, the Chance Bronze-Bodied S1520 "P.C." Hot Line Clamp is the newest development. This small clamp has a wide range from 1/0 std. to 8 solid copper main line or jumper. It is similar in design to all other Chance "P.C." clamps in that the clamp jaws hang on to the conductor without turning as the clamp is tightened and jaws are wide enough to make contact with all the outside conductor strands. And, like the larger clamps in this series, this clamp has excellent current-carrying capacity; low contact resistance. It will carry the maximum current allowed for the largest jumper wire without overheating any part of the clamp.

This new compact clamp is especially desirable for use with bail clamps to connect apparatus or equipment.

Kindred Chance bronze clamps are available for conductor sizes to 1500 MCM Stranded copper main line 300 MCM str. cu. jumper.

FOR BI-METAL - EITHER WAY—use Chance AGP Hot Line Clamps. These clamps are coated with high density, fortified cadmium that permits aluminum-to-copper, aluminum-to-aluminum, or copper-to-aluminum taps. The thick cadmium coating wards off corrosion and electrolysis in the connection. Thermal expansion of the clamp is compatible with aluminum conductors keeping contacts tight. And, since the thermal coefficient of copper is less than aluminum, copper conductors are not deformed even under extreme temperature variations. AGP Clamps in four sizes cover a range from No. 8 solid copper to 1500 MCM stranded and comparable aluminum sizes.

Some advantages, important to you, that all these Chance Hot Line Clamps have in common are the careful selection of alloys; the fine-grained heat-treated castings automatically controlled and continuously inspected in the manufacturing process; protected eye-screw threads that run in a chamber of all-weather corrosion-inhibiting lubricant; wide jaws for maximum contact, high conductivity; ample body for heat dissipation and resistance to heavy surges; strength to endure without mechanical failure and balance to keep down vibration fatigue and lengthen conductor life.

Another all-important step in making good Hot Line Taps is taken care of automatically when you buy Chance packaged clamps because z.l.n. 100 contact aid is factory-applied to the contact area. Printed on the sealing tape of each package is a reminder to clean and coat the conductor—when linemen heed this advice a good connection is virtually certain.

ABC Industries

A. B. CHANCE CO.

CENTRALIA, MISSOURI

(A. B. Chance Company of Canada, Ltd., Toronto)

CC60-5

For phone number of closest representative see advertising index in back of book.

FAULT CLOSING

S&C metalclad switchgear meets all requirements of new National Electric Code for fault closing, short-circuit interruption. Performance proved by high power testing at KEMA laboratories.

S&C metalclad switchgear can close on any fault up to 60,000 amps

No danger to equipment—no danger to operator even if he closes load interrupter switch on the heaviest faults. S&C's new line of metalclad switchgear is rated as high as 40,000 amps fault closing, 500 mva short-circuit interrupting at 14.4 kv. And at 4.16 kv, the corresponding ratings are 60,000 amps, 250 mva!

Here's how it works: 1) Fault never flows through interrupting unit when switch is closed . . . it flows through separate arcing contacts; 2) Arcing is minimized and magnetic forces are overcome by quick-make, quick-break toggle action no matter how slowly operator closes handle.

Short-circuit interrupting duty (up to 500 mva) is handled by a new boric acid power fuse, the Type SM, which features multiple bore construction to handle low, medium, and high faults.

The simplicity of the S&C design—power fuses for short-circuit interruption and load interrupters for manual or automatic load switching—enables you to save as much as 50 percent on your switchgear investment. Why not consider S&C Metalclad Switchgear for your high voltage power systems? In industrial plants and commercial and institutional buildings there are rarely any transient faults, so there is no real need for the automatic reclosing ability of the more expensive circuit breaker type of switchgear.

For more information please consult the telephone directory for your nearest S&C sales office.

S & C ELECTRIC COMPANY

4425 Ravenswood Avenue • Chicago 40, Illinois

Specialists in High Voltage Circuit Interruption since 1910

S&C

► **Roland R. Blantz,** formerly manager of training and safety for Portland General Electric Co., has been appointed assistant manager of its industrial relations department. Blantz started his career with PGE in 1936 after being graduated from the University of Oregon. He has served as a lineman, line instructor and general foreman. He was made safety engineer in 1949 and under his supervision PGE's lost-time accident frequency has been cut 90%. During his tenure the company received five awards for superior safety performance. In his new job, Blantz will continue administrative duties in connection with training, safety and health service. He will also assist in labor relations work.

Blantz

► **Maj. Gen. O. E. Walsh,** U.S.A. retired, vice-president of Portland General Electric Co., was among the guests at Gen. Douglas MacArthur's 80th birthday party at the Waldorf Towers in New York City Jan. 26. General Walsh was a member of MacArthur's staff during World War II.

► **Rollie Gabel,** promotion director for Portland General Electric Co., has been appointed chairman of the Portland Rose Festival's Grand Floral Parade. Gabel said theme of the parade in June will be "Famous Cities of the World."

► **T. W. "Bill" Lowry,** assistant manager of Portland General Electric Co.'s Willamette Valley Division, has been elected chairman of the Salem Planning Commission. He has been a member of the body since 1954.

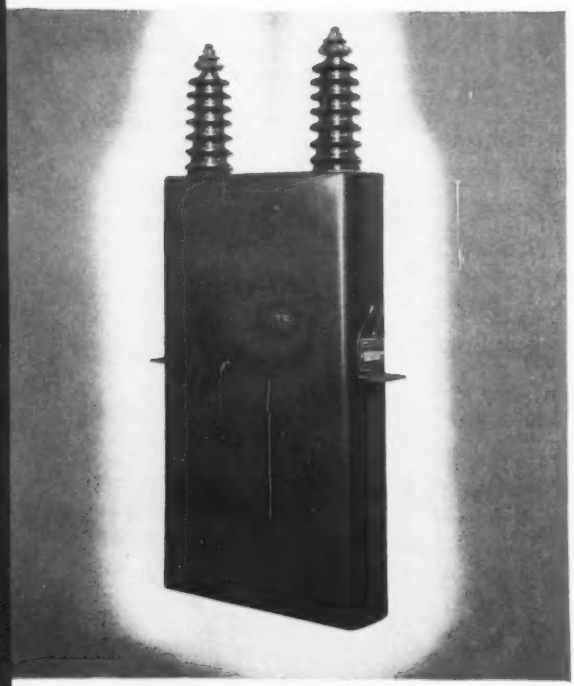
► **Jack Beckett,** for the past 15 years chief engineer for the Wesix Electric Heater Co. and prominent in electrical industry affairs, resigned to become affiliated with the Hewlett-Packard Co. at Palo Alto. He will be engaged in production direction for the electronics firm. He has also resigned from the Bay Area Rapid Transit District as Marin County representative, because after April 18 he will move to the Peninsula.

► Pacific Power & Light Co. will set up an industrial reference library in its Portland headquarters and has appointed **William L. Hutchinson,** formerly librarian at Linfield College, McMinnville, Ore., to organize and direct it. **Dr. James B. Ward,** director of research for PP&L, will be in over-all charge. Before going to Linfield, Hutchinson was head librarian at Ottawa University. He received his degree in library science from the University of Illinois in 1948.

Hutchison

► **Harold W. Burdekin** has been appointed manager of dealer sales for the Northwest district, General Electric Co.'s electric major appliance sales and distribution department, with headquarters in Seattle. He replaces **Howard Oliphant,** who has been transferred to Salt Lake City. Burdekin has been with the company since 1949 at Cincinnati, Ohio, and Washington, D. C.

G-E "COMPACT ISOKRAFT* 50" CAPACITORS OFFER



*Trademark of the General Electric Co.

1200 KVAR, UP

General Electric's new "COMPACT ISOKRAFT 50" capacitors help speed equipment installation. These new 50-kvar units, the lightest and smallest available, make possible a switched 1200-kvar, three-segment cluster equipment weighing only 2300 lbs. Designed for installation flexibility, the equipment is suitable for installation in three segments or it can go up the pole in one piece. The heaviest segment weighs less than 900 lbs.

Available in 900- and 1200-kvar ratings, the new three-segment cluster equipment takes less time to install. Capacitor units are factory assembled and wired in three racks. Each rack contains all of the capacitors in one phase. Only the

► **Gordon W. Smith** has been appointed district sales manager of TV, radio and stereo hi-fi in the northern California territory for Packard Bell Electronics. Smith replaces **Jack Fletcher,** who retired last month.

► Harry Pearson, distribution engineer for Portland General Electric Co. for the past 11 years, has joined Rogers Engineering Inc., to take an assignment in Bangkok, Thailand, where he will handle distribution engineering in an ECA program to rebuild a portion of the Siamese capital. Pearson was with Washington Water Power Co. and Pacific Power & Light Co. before joining Portland General Electric.

Pearson

► **Howard Calderwood** has joined the sales staff of Northwest Sales Co., 1603 N. W. Johnson St., in Portland. He was formerly with Portland Electric & Plumbing Co. and with Eoff Electric Co.

► Pacific Power & Light Co. has added a second fish biologist to its research department with engagement of **Jack D. Remington** to serve as assistant to Dr. Roy Hamilton in fisheries research projects sponsored by the company. Remington was senior biologist assigned to the Fraser River sockeye salmon rehabilitation project of the International Pacific Salmon Fisheries Commission. Before joining the international commission in New Westminster, B. C., he was on the staff of the Colorado Game and Fish Department. He attended Ohio State University and the University of California, and received his master's degree from Colorado State University in 1951.

Remington

► **George Eicher,** Portland General Electric's aquatic biologist, has been retained as an advisor on fishery facility developments by Western Development & Power Ltd., a subsidiary of British Columbia Electric Co. Busy as a consultant along with his regular duties for PGE, Eicher has developed a fish protection plan for the Iron Canyon project on the Sacramento River and has been advising Bechtel Corp. on fishery questions in connection with Wells Dam on the upper Columbia.

► **John M. Hottenstein** has been made manager of the Kelman Power Circuit Breaker Division of I-T-E at Los Angeles, succeeding **A. E. MacKenzie,** recently named to the corporate post of vice-president, power equipment. **John R. Chamberlin,** who has managed the circuit breaker section, switchgear division, will replace Hottenstein as switchboard section manager. Hottenstein has been with I-T-E seven years. Before that he was chief engineer for the Roller Smith Co.

Hottenstein

► **William C. Sanders** with Graybar Electric Co. for 47 years, retired recently in Spokane.

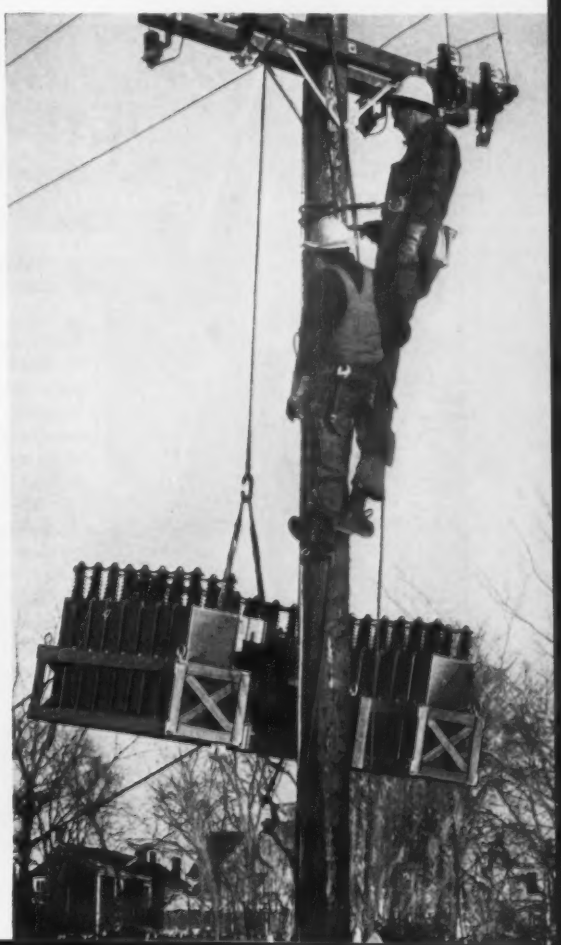
IN ONE PIECE

connections between the three phases, line connections, plus control power connection for switched equipments are required in the field. Switched equipments include three, single-phase capacitor switches and a control wiring junction box mounted on the center segment.

For complete information, contact your nearest G-E Apparatus Sales Representative, or write for bulletin GEA-7061, to General Electric Company, Section 445-33, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC



PMC
FIELD
PROVEN
CONTROL

OVER 250,000 INSTALLATIONS!
A complete line of precision photoelectric controls & accessories for outdoor lighting.
PRECISION MULTIPLE CONTROLS., RIDGEWOOD, N. J.

It took 29 yrs. research to make

JAQUES Hydraulic HOLE DIGGERS
Fastest, Strongest, Safest most economical!

Jaques TJ-254 digging at 30 degree angle
Operates at up to 45 degrees

Time-and-money-saving features of Jaques All-Hydraulic Hole Diggers took 29 years to develop. Rugged, versatile Jaques TJ-254 mounts on standard trucks, drills holes up to 48" diameter, to 25' depth, in hardest soil or rock — FASTER, CHEAPER, EASIER than competitive machines! Fewer moving parts insures ***minimum down-time, maintenance, operating costs.*** Shock-resistant device relieves strain in rock digging. Simple to operate with only 3 primary adjustments. FREE DEMONSTRATION WILL PROVE THESE CLAIMS!!

-----FREE----

TEXOMA ENTERPRISES, INC.
HIGHWAY 75 North, SHERMAN, TEXAS

☐ Send me FREE detailed literature.
☐ Have representative call. No Obligation.

NAME_____
TITLE_____
ADDRESS_____
CITY_____
STATE_____

TEXOMA ENTERPRISES, INC.
HIGHWAY 75 NORTH • SHERMAN, TEXAS

► Appointment of David F. Roach as manager of the Portland apparatus office of Westinghouse Electric Corp. was announced by Kendall L. Howe, North Pacific district manager. Roach replaces H. Norman Miller who retired May 1 after serving the company for 33 years.

Roach

Roach joined Westinghouse in 1942 at the Indianapolis apparatus sales office. After three years in the Navy submarine service, he was named a sales correspondent in East Pittsburgh, Pa. He was transferred to San Francisco in 1947, where he has been area sales manager since 1954.

He will make his headquarters at the new Westinghouse apparatus office at 1414 N. E. Grand Ave.

► **William D. Fenton** has been appointed regional public relations manager for Sylvania Electric Products Inc. with headquarters in the Burlingame office. He was formerly in charge of such activities for the WEMCO electronics shows.

► **George E. Baker,** formerly lighting engineer for Pacific Gas and Electric Co. at San Jose, has joined Curtis-AllBrite Lighting Inc. as sales engineer. **Paul Bixel** also has joined Curtis-AllBrite. He was formerly with North State Electric Supply Co. as lighting salesman.

► **Paul M. Thome,** who has been the Westinghouse Lamp Division sales representative in Salt Lake City, was recently transferred to Sacramento.

► **W. A. Hansford** has been appointed Los Angeles branch manager, apparatus and supplies, for Westinghouse Electric Supply Co., replacing **W. A. Matzinger,** who retired March 1 after 37 years' service.

► **Robert J. Haldeman** has been made controller of Packard Bell Electronics Corp. He has been assistant treasurer since 1953 and will continue in that capacity.

► **Edward Estrin** was elected vice-president in charge of manufacturing for Western Insulated Wire Co., Los Angeles. He has been with the company for 14 years and has worked in sales, production and as factory manager from 1952-1959.

► Appointment of **W. C. Henderson** as manager, utility sales, and of **A. W. Leighton** as manager, industrial sales, Los Angeles district, has been announced by Allis-Chalmers Industries Group. Henderson, who succeeds Leighton as manager of utility sales, had been a sales representative in the Los Angeles district since 1953. Leighton had been manager of utility sales since 1956. He was transferred to the Los Angeles district in 1953 as a sales representative after working in the Kansas City and Cleveland districts.

► **W. C. White** has been made Graybar manager at Sacramento, Calif. He joined the company in 1939 at Salt Lake City, returning to that office after service in World War II. He was transferred to San Francisco as manager, inside sales, in 1956 and since 1959 has been acting manager at Sacramento.

► **Karl L. Lepple,** who has been responsible for Landers, Frary & Clark housewares sales in California, has been appointed Western regional manager. He will supervise sales activities for all Landers products in the region, which includes market areas of Los Angeles, San Francisco, Seattle and Salt Lake City. A native of San Francisco, Lepple joined the company 10 years ago as dealer development representative.

Lepple

► **J. G. Hart,** formerly assistant commercial manager of California Electric Power Co., has been made assistant chief engineer. He will serve in that capacity along with W. J. Lindstrom, present assistant chief engineer.

► **Charles E. Muller** has been made manager, utility sales, for Allis-Chalmers Industry Group, San Francisco district. He was a sales representative in the Chicago district before being assigned to a similar position in the San Francisco district in 1958.

► **Otis A. Taylor,** who has been sales associate of **Ray Camnitz** and succeeded him as territorial representative when the latter retired after 25 years with Day-Brite Lighting, was appointed sales representative in the Oregon territory with headquarters at 6346 N. E. Rodney, Portland.

Truck Equipment Company Dept. 25
3963 Walnut Street, Denver 5, Colorado

Gentlemen:

I am interested in how Truco can solve my stringing and reconductoring problems. Please send your Tensioning Brochure *today.*

Name

Firm Title

Address

City State

Pulls and Tensions FOUR Conductors Simultaneously

▽

Saves More Than 75% in Labor Costs

▽

Truco

Saves More Than 75% of Initial Equipment Costs

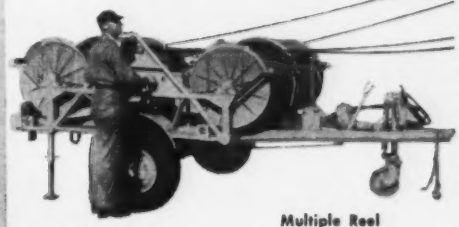
▽

Uses ONE Puller and ONE Tensioner to do the Complete Stringing and Reconductoring Job

▽

Strings or Replaces Conductors Safely, Simply and Efficiently

▽



Multiple Reel Pulling Trailer

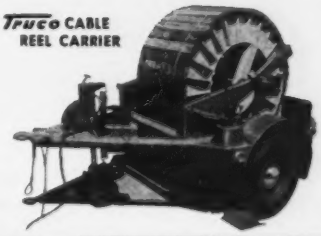
NEW TENSIONING EQUIPMENT

Multiple Reel Stringing Trailer

Complete utility and maintenance hydraulic equipment

Truco AERIAL LADDER

Truco CABLE REEL CARRIER



Truco AERIAL LIFT

Truco HYDRAULIC DERRICK

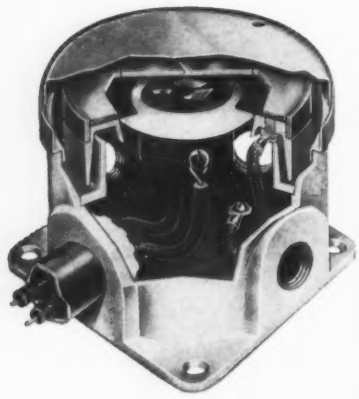
Write or phone for full details

Truco

Ask for name of nearest distributor

TRUCK Equipment COMPANY

3963 WALNUT ST. • AComa 2-7905 • DENVER 5, COLORADO



2 Part TIN LID

Permits Pouring

CONCRETE TO VERY TOP

This No. 130 Series cast iron, adjustable floor box with 3½" or 4¼" brass cover plate is suitable for power or telephone service—and is equipped with ground wire.

A 2 part tin lid is provided so that concrete can be poured to very top of box in one operation. Formerly pouring was done in two concreting operations.

After concrete has hardened, the top part of the 2 part tin lid can then be removed along with the top adjusting section, providing unlimited access to wiring.

Listed under re-examination services of Underwriters Laboratories, Inc.

Latrobe Products • Non-Adjustable Floor Boxes Adjustable Floor Boxes • Gang Boxes—Cover Plates Junction Boxes—Nozzles • Pipe or Conduit Hangers Insulator Supports • Cable Supports—Fish Wire Staple and Cable Clips

Sales Representatives in all principal Cities:

PAYNE & SLOAN
1101 East 5th St. Los Angeles 13, Calif.

L. F. CHURCH COMPANY
750 Natoma Street San Francisco 3, Calif.

HARVEY M. OLMSTEAD COMPANY
PO Box 5512 T.A. Denver 17, Colo.

WIANT PRODUCTS COMPANY
1231 N. W. Hoyt St. Portland 9, Ore.

R. C. ENGLISH & ASSOCIATES
4229 122nd, S. E. Bellevue, Wash.

SOLD ONLY THRU WHOLESALERS

Fullman
MANUFACTURING COMPANY
1209-1215 JEFFERSON ST.
LATROBE, PENNSYLVANIA

Salt River Appointments

Charles K. Marshall, formerly with North American Aviation Corp., Los Angeles, and Harron-Rickard-McCone Co., Scottsdale, Ariz., has been named supervisor of commercial and industrial sales for the Arizona Salt River Project.

Two promotions were also announced. Don G. Parlett, with the project since 1953, was promoted from supervisor of industrial development to assistant sales manager and supervisor of area development. Clayton L. Holm was promoted from commercial and residential power consultant to supervisor of residential sales. He has been with the project since 1953.

► **Carlyle B. Stitt** was recently made South Pacific district agency and construction manager for Westinghouse Electric Corp.'s Apparatus Division. **John R. Read,** area sales manager, it was also announced by Spence Purnell, district apparatus manager, will supervise the electric utility group in the Los Angeles metropolitan area from headquarters at 600 St. Paul Ave., Los Angeles.

► **Gordon O. Richards,** who has been operating manager for the Salt Lake City branch of Graybar Electric Co., was promoted to electrical construction sales manager of the San Francisco district. A Jamison Jr. of Akron, Ohio, was named operating manager in Salt Lake. Richards, a graduate of the University of California and University of Utah, has been with Graybar 15 years, 10 of them in Salt Lake City.

► **George Markofer,** dealer representative on the sales department staff of the Sacramento Municipal Utility District for 12 years, died of a heart attack early in January. One of the founders of the Sacramento Valley Electrical League, he formerly was employed by the Pacific Gas and Electric Co.

► Elevated to the grade of Fellow in the American Institute of Electrical Engineers: **William R. Johnson,** chief electric generation and transmission engineer, Pacific Gas and Electric Co., "for contributions to the development of a major electric generating and transmission system."

► Don Piper has been appointed sales manager of **Sues, Young & Brown's** Appliance Division in Los Angeles. He was formerly assistant manager of the distributing company's Zenith sales division.

Kallen

Jensen

► **Robert G. Kallen** has joined Portland General Electric's commercial-industrial sales promotion section and will assume duties connected with illumination sales. **Paul Jensen** has been transferred from residential sales campaigning to work in sales promotion for appliances, Medallion Homes and allied promotional work.

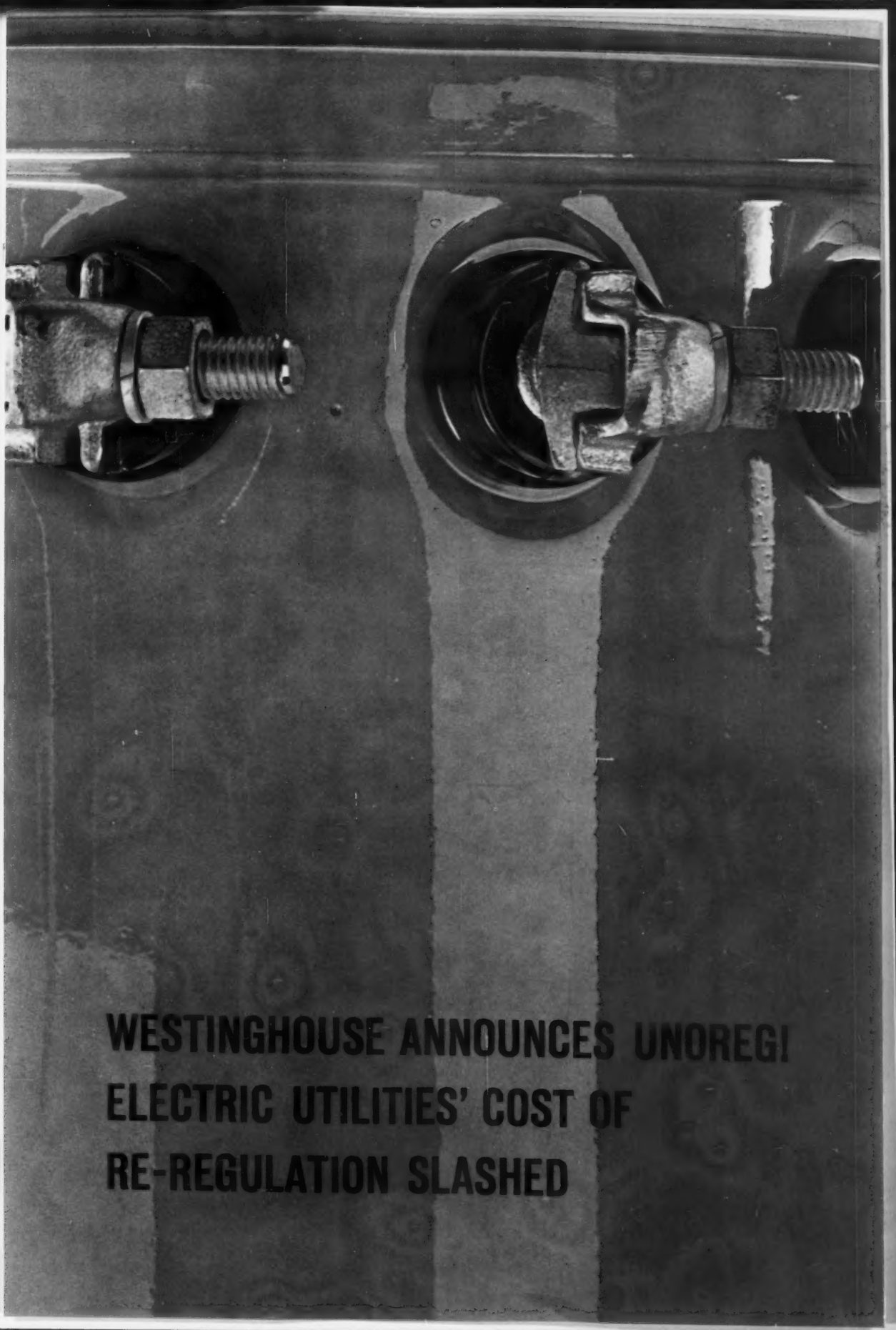
► Appointment of **Gabriel** "Gabe" **Brody** as a lighting sales engineer for the southern California area of Western Lighting Corp. was announced by Milton Weiner, sales manager.

► **Wilbur W. German,** 56, of Butte, Mont., a vice-president of the Montana Power Co., died on March 29. Born in Lincoln, Nebr., he received his early education in Washington, D. C., Pittsburgh and Denver. He was graduated from Cornell University with a degree in electrical engineering. He joined Montana Power in 1931, working up in the organization to vice-president in 1957.

► **Harry R. Noack** whom electrical industry veterans will remember for his mustache, cigar and homing pigeons, died April 2 in Oakland, aged 84. Born in Oroville 1875, he studied medicine, took a correspondence course in electrical engineering and in 1898 worked for John Martin Co. which later was merged with Pierson, Roeding & Co., of which he became president. After World War I he sold out to Pacific States Electric Co., became its vice-president and when it became General Electric Supply Corp. he was commercial vice-president until retirement after 50 years in 1948.

► **S. V. Monsees,** city electrical engineer for San Diego, retired March 31. He was a past chairman of the San Diego Section, Illuminating Engineering Society.

► **Rudolph C. Stange,** assistant general manager, National Board of Fire Underwriters since 1945, retired after 40 years of service. He was in charge of the San Francisco office. W. Victor Slevin was named in his post.


WESTINGHOUSE ANNOUNCES UNOREGI
ELECTRIC UTILITIES' COST OF
RE-REGULATION SLASHED

UNOREG UNIVERSAL VOLTAGE REGULATOR . . . TO BRING ELECTRIC UTILITIES THE LEAST EXPENSIVE, MOST VERSATILE REGULATOR FOR ANY FEEDER DESIGN TESTED, STUDIED OR KNOWN, REQUIRING RE-REGULATION. UNOREG, WESTINGHOUSE NEW AND EXCLUSIVE UNIVERSAL VOLTAGE REGULATOR PROVIDES:

1. IMMEDIATE, ECONOMICAL RELIEF FROM THE CONSTANT PROBLEM OF LOW-VOLTAGE COMPLAINTS
2. A NEW IDEA IN DISTRIBUTION SYSTEM DESIGN, WITH A FLEXIBLE METHOD OF VOLTAGE REGULATION

Unoreg* is a new and vital way of solving the ubiquitous problem of distribution voltage regulation. As loads grow and lines lengthen, re-regulation becomes increasingly important. Supplementary voltage regulation has always been expensive. Here's how Unoreg can bring about an abrupt reduction in the cost of re-regulation:

ACTUAL CASE...UNOREG SAVES $5861 OF REGULATOR EQUIPMENT COSTS ON A SECONDARY

In this first instance, it will be demonstrated that Westinghouse Unoreg can save the electric utility almost $6000 on regulation. On a typical 4160-volt system, the substation regulator maintains voltage at 125 volts maximum, 120 minimum. Peak load voltage at the end of the distribution line, without re-regulation, is four volts below acceptable minimum. Conventional re-regulation technique would require a 3-phase bank of 50-kva units on the system—with satisfactory service resulting. The cost? A total of $7961 in capital investment.

Let's try Unoreg. First, raise substation bus voltage from 125 to 129 volts. Service to customers at the end of the line will then be adequate. For nearby customers, voltage is too high.

This voltage is then bucked down . . . bucked down . . . by applying Unoreg units to 14 distribution transformers at the head end of the feeder. All customers—all points on the feeder—are at satisfactory voltages, as with conventional equipment. The cost? Fourteen Unoregs, at $150 each, represent a total capital investment of only $2100. Compared to $7961, Unoregs save this system $5861 in equipment first cost. Dramatic savings . . . proved savings . . . and they can be yours!

AND ANOTHER CASE . . . UNOREG CUTS CAPITAL COSTS $12,000 OR 50%

A 13.2-kv system, with station voltage at 125 volts, is confronted with the same operating problem. Again, conve banks of 19-kva regulators, and one thus boosted. The bill for regulators in

In applying Unoreg to the proble to 129 volts. Unoregs are placed at bucking regulation. Toward the end of boosting application. Forty units are same services performed, Unoreg has ment.

AN OPERATING EMERGENCY...U COMPLETELY SELF-REGULATING

For instance, there's an outage of the The entire primary feeder circuit is d of the circuit may be supplied from "new" circuit may find itself at the tai feeder. Unoregs in bucking regulatio The result is obviously better servic emergency conditions.

HOW YOU CAN USE WESTINGHO DRASTICALLY CUT RE-REGULAT

Every utility can point to situations examples given here . . . and rememb

In general, the kva primary feede square mile govern the need for supp the thermal limit of the primary feede loadings, represented by any point w tion. The area above the band repres system design renovation.

WESTINGHOUSE POWERCASTIN REGULATION PROBLEM. FINDS FROM AMONG 2,488,320 POSSI OF ENGINEERING MAN-HOURS F

What does it take to deliver a predete most economical design for distrib What is the optimum combination o voltages to expand the system? What circuits and substations? Where is it system voltages?

Finding the answers to these que it is a computer-size job. Westinghou logic, and new techniques of system distribution system combinations. Th ble load patterns . . . peaks, saturat system voltages and primary feeder additional data for the problem. ratings, number of homes per transf complete the system design data. A are possible from this complement casting studies them all.

The computer then designs al ratings, location, costs for all equi meet design criteria, or prove too co

*Trade Mark

UNOREG...AND A TOTALLY NEW CONCEPT OF DISTRIBUT

conventional design calls for three 3-phase
d one single-phase unit. System voltage is
tors in this arrangement comes to $18,120.
problem, substation voltage is first boosted
ed at required points near the station—in
end of the line, a few Unoregs are placed in
s are required, at a cost of $6000. For the
reg has saved this utility $12,000 in equip-

Y...UNOREGS BUCK OR BOOST, ARE ATING

of the high-voltage supply to the substation.
it is de-energized. To restore service, parts
d from adjacent feeders. A section of this
the tail end rather than at the head end of its
gulation here automatically begin to boost.
service voltage for your customers under

NGHOUSE UNOREG . . . AND ULATION COSTS

ations on its own system exactly like the
member, these were actual cases.
y feeder loading and load density in kva per
r supplementary voltage regulation. Indicate
y feeder. Then . . . load densities and feeder
oint within the band, will require re-regula-
represents overloading—that requires major

STING MAKES 3-YEAR ASSAULT ON NDS OPTIMUM DISTRIBUTION SYSTEM POSSIBILITIES; TO SAVE THOUSANDS URS FOR ELECTRIC UTILITIES

predetermined quality of service? What is the
distribution transformers and secondaries?
tion of subtransmission and primary feeder
? What are the optimum load capabilities of
re is it practical and economical to regulate

se questions is no longer a man-size job . . .
inghouse Powercasting, employing computer
system simulation, has determined optimum
ns. The method is, first, to program all possi-
aturation and void factors. Various levels of
eeder design data are fed to the computer as
lem. All possible distribution transformer
transformer, and secondary conductor sizes
ata. A total of 2,488,320 complete systems
ement of factors . . . Westinghouse Power-

gns all these possible systems, calculates
l equipment. Those "systems" that do not
too costly, are discarded. Final selection by
the computer is that system which provides optimum conditions from bulk power source to customer, and total cost.

In Powercasting, Westinghouse makes available to the electric utility industry a major new tool for distribution system planning . . . accurate, dependable, long-range.

UNOREG'S 1¼- AND 2½-KVA MODELS TO BLANKET REGULATION NEEDS FOR TRANSFORMERS RATED 1½-50 KVA

Unoreg is completely separate from the distribution transformer. Ease and flexibility of application are evident. Two models handle 8 transformer kva ratings. Inventory costs are at a minimum. When the regulator is built into the transformer, obviously all 8 ratings must be stocked. Taking into account all primary voltages, Unoreg, in just two ratings, can be applied to 603 styles of transformers.

And here are additional, and specific, cost savings. This 1¼-kva Unoreg can be installed on an existing transformer at an equipment cost of only $150 plus installation. The cost of replacing a transformer-with-built-in-regulator unit includes the higher expense of changeout, and the premium price of the new combination equipment. So Unoreg can be instrumental in lowering your total system costs.

At a later date, Unoreg can be put in service at a second location without disturbing the transformer to which it was originally applied. This fact is difficult to price, but system operators will welcome this flexibility for temporary emergencies or changing voltage conditions. Or, Unoreg can serve any individual load when required, such as a farm or end-of-line customer . . . again flexibility for spot situations.

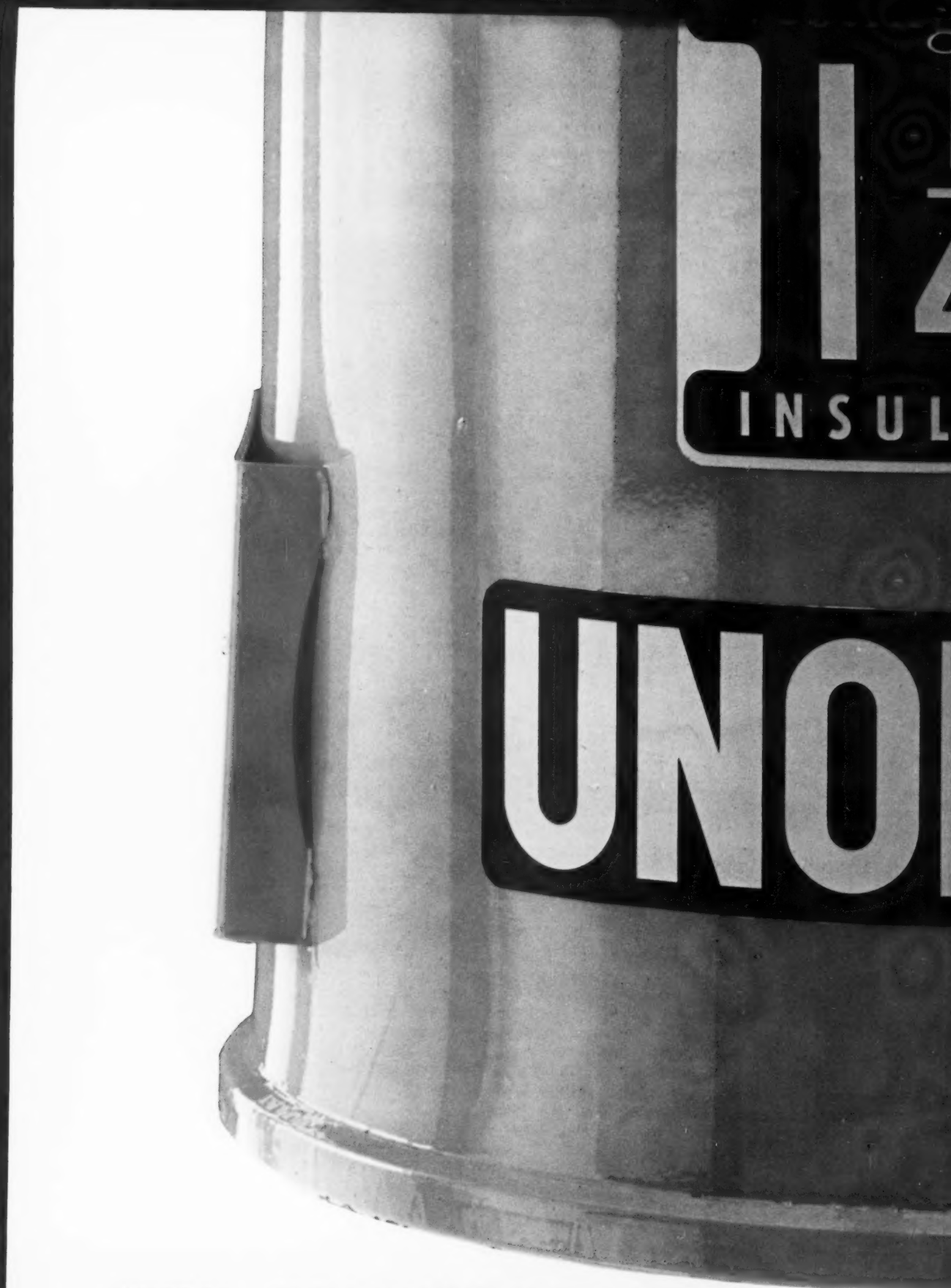
UNOREG MAINTAINS 2½-VOLT EFFECTIVE BANDWIDTH UP TO 180% OF TRANSFORMER RATING

On secondaries of 120/240 volts, Unoreg will provide a plus or minus 5% voltage regulation at point of consumption—a 2½-volt bandwidth. Unoreg can be operated up to 180% of its nameplate rating . . . with no loss of normal service life.

BUTION VOLTAGE REGULATION...SLASH CAPITAL INVESTMENT

Westing

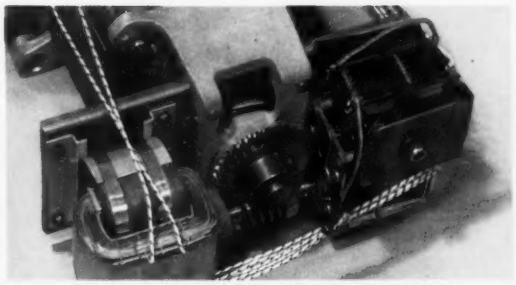
nghouse



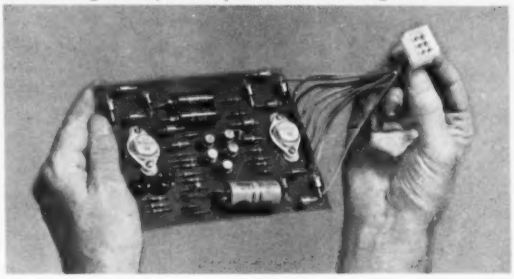
UNOREG...AND A TOTALLY NEW CONCEPT OF DISTRIBUTI

UTION VOLTAGE REGULATION...SLASH CAPITAL INVESTMENT

Changeout control quickly by merely unplugging and removing.



Induction regulator operates by direct drive from a gearmotor.



Voltage control element is a solid state, completely integrated relay.

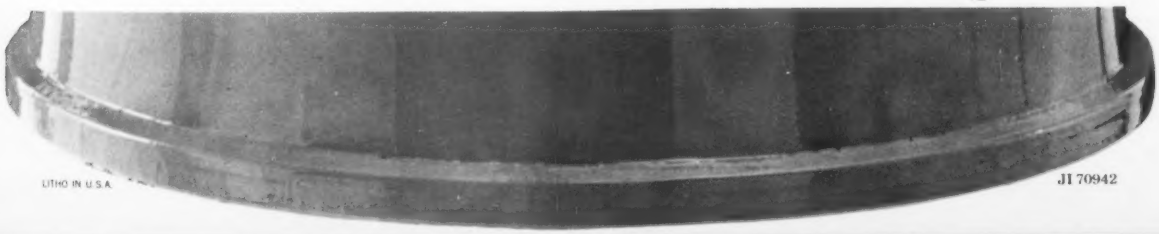
UNOREG IS COMPLETELY SELF-PROTECTING. Unoreg is an induction regulator and is operated by a gearmotor. There are no moving parts or taps except the plus-minus 90-degree rotation of the rotor, and parts of the gearmotor. Insulation meets the 30-kv BIL of the transformer. Bushing gaps protect the rotor-stator assembly from lightning.

The voltage control element is a solid-state, integrated relay with no moving parts or contacts. Components are temperature-compensated for precise control at all ambients. For maximum safety, the control transformer isolates the device from abnormal voltages.

COMPACT, STANDARDIZED FOR FAST, INEXPENSIVE INSTALLATION. The 1¼ kva Unoreg is only 21" high, 12¼" in diameter. Standard low-voltage distribution transformer bushings are color-coded for quick, easy connection—brown for input, green for output. Tank-mounting bracket has standard 12" spacing for bolt holes . . . the same as those of the transformer. Simplifies installation. Protecting this compact equipment is Westinghouse famed Coastal Finish which will stand up to the worst of weather conditions.

You'll want to know more about Unoreg and how you can take advantage of these huge savings. Call your Westinghouse representative . . . he has the information.

YOU CAN BE SURE...IF IT'S **Westinghouse**

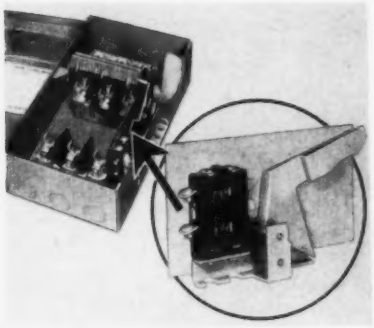


LITHO IN U.S.A.

J1 70942

PRODUCT NEWS

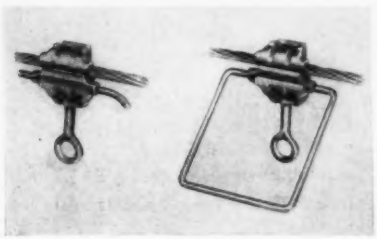
New Designs and Applications



Interlock Kit

(1) *Square D Co., 4335 Valley Blvd., Los Angeles, Calif.*

This new electrical interlock kit permits field installation of additional contacts in safety switches. Because the interlock contacts make or break ahead of the main switch blades, the new interlock can be used within control circuits. The new units are supplied with one normally open and one normally closed contact; represent cost savings because they utilize standard three-pole switches from stock rather than special-order four-pole switches. The operating mechanism is rated for heavy-duty service.



Clamps and Stirrups

(2) *Fargo Mfg. Co. Inc., 845 Main St., Poughkeepsie, N. Y.*

The new BC series was designed to give extra contact, more rapid heat dissipation, better interstrand connection and conductor encirclement. The soft pure aluminum spacer assures a short, high conductivity current path between conductors, the manufacturer states.

After crimping the spacer ears to securely hold the tap, these clamps are easily installed by one man using standard tools, it is stated. The stirrups of the BC-AHS are preformed plated copper, crimped in the spacer bar at the factory. The BC series and other Fargo products are distributed by Line Material Industries.

Compact Lighting System

(3) *Sylvania Electric Products Inc., Lighting Products Division, 60 Boston St., Salem, Mass.*

Combining a newly developed aperture lamp and an optically controlled fixture, a compact lighting system developed by Sylvania is claimed to have a brightness level 338% greater than any fluorescent unit commercially available. According to the manufacturer, brightness gain represents 22,000 f-l compared to the 6,500 level achieved last year.

The Controlled Powerbeam system throws a narrow band of light for a considerable distance with a minimum amount of glare and, according to the manufacturer, will find many uses in applying fluorescent lighting to areas where it formerly had not been feasible.

Uses suggested by the manufacturer include low-mounted highway lighting, bridge and tunnel lighting, expressway turn-offs, service stations, building facade floodlighting, edge lighting for signs.

Another potential application is as a linear fluorescent automobile headlight.

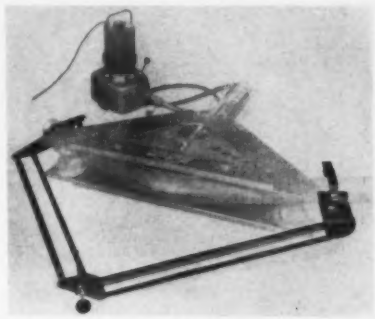
Lightweight Stringing Block

(4) *Sherman & Reilly Inc., 1st & Broad Streets, Chattanooga 2, Tenn.*

This new conductor stringing block is claimed to have highest ultimate strength with minimum weight. Construction is aluminum alloy throughout.

Permanently bonded type GNA neoprene sheave lining gives maximum protection to both sheave and conductor, the manufacturer states. The sheave is mounted on antifriction shielded ball bearings. There is an Alemite fitting for pressure grease lubrication. The conductor guard is an integral part of side frame and prevents fouling of pulling line or conductor.

Ultimate strength is 35,000 lb. The unit comes in sizes through 28 in. for conductor to 1,780,000 cm.



Indicator

(5) *Greenlee Tool Co., 2136 12th St., Rockford, Ill.*

A scale to indicate degree of bend on any ½- to 6-in.-diameter pipe has been announced by this manufacturer. The No. 1807 pipe bending degree indicator fits any hydraulic pipe and conduit bender operating in a horizontal position. According to the manufacturer, time-consuming, on-the-job figuring is eliminated and pipe need not be removed to determine the degree of bend. Large sweep bends may be completed easily by following instructions supplied with each degree indicator, the manufacturer states.

NO OTHER SIDE-BREAK DISCONNECT GIVES YOU ALL OF THESE OPERATING ADVANTAGES

- **Correct contact always maintained at blade tip even if crossarm warpage distorts the switch base.**
- **All blades engage fully in the break-contact jaws without precise adjustment of the inter-phase rods.**
- **Less time and labor to install with Kearney original wide-tolerance mechanical design.**
- **Easiest, surest ice-breaking ability available on both opening and closing.**

This newest Kearney development solves long-existing operating problems of crossarm mounted group operated side-break disconnects. The best supporting structure or crossarm construction may . . . due to ice loads, age, wind or line strain . . . deflect enough to distort the switch bases, or alter the relative positions of the three phases. This often causes loss of contact or failure of all blades to close completely in conventional disconnects with both rigid blades and stationary break-contacts.

Kearney's advanced design features a self-aligning blade constructed to permit controlled vertical movement and axial rotation. This automatically compensates for base distortion . . . keeps the blade tip correctly aligned in the contacts. The break-contact swings 30-degrees with the blade as it is opened or closed, producing high leverage ice-breaking ability and full wiping of the silver current transfer surfaces. On closing, the blade tip fully engages the break-contact before the contact moves from its angular open position, compensating for any shift in position of the switch bases. This same feature also allows considerable freedom in interphase rod adjustment, enabling Kearney *Self-Aligning* side-break switches to be installed faster and more economically than other types.

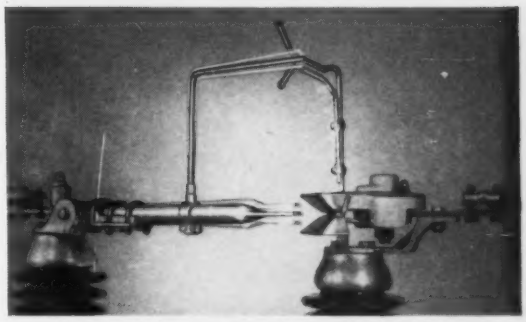
The details of these original features for maintenance-and-adjustment-free operation are shown on the facing page.

Kearney's

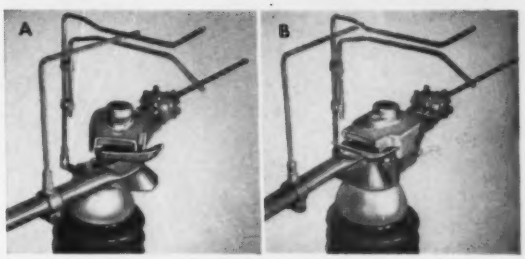
Self-Aligning SIDE-BREAK DISCONNECTS

...always make positive contact, even if the supporting structure warps, twists, bows or settles.

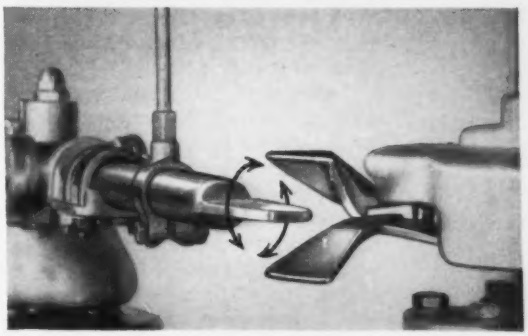
Self-aligning blade moves in a vertical plane to re-establish the original relationship between blade tip and contacts if supporting structure warpage distorts switch base. Wide mouth contact jaws assure blade entry into the contacts. Vertical 1¼" movement more than corrects for extreme cases of misalignment.



Break-contact swings 30° in the plane of blade travel as switch is opened or closed, providing highest leverage ice-breaking and full wiping of the current transfer surfaces. Note that the blade tip is fully engaged, and full contact is maintained (A) through the final 20° of blade travel to the fully closed position shown at (B). This feature allows more latitude in phase rod adjustment than other designs.



Blade rotates 12° on its longitudinal axis. If base distortion has affected blade-contact alignment, the blade tip will rotate as it enters the break-contact to keep all contact surfaces parallel, automatically restoring contact alignment. Friction reducing construction at all rotation points minimizes operating effort.



Switch carries full-rated load current well within NEMA temperature rise, from a fully closed position to 20° partially open position. Ratings available, 7.5 through 69 kv, 600 amperes. Equipped with conventional or whip-type arcing horns... torsional or spade-type operating mechanism. May be mounted horizontally, vertically, or underhung.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Avenue, St. Louis 10, Missouri

IN THE WEST: for prompt service, contact Kearney's West Coast Distributor, **Maydwell and Hartzell, Inc.,**
Los Angeles • Seattle • Portland • San Francisco • Spokane • Phoenix.

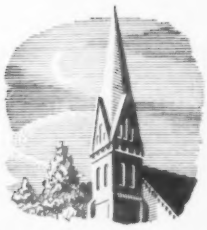
397

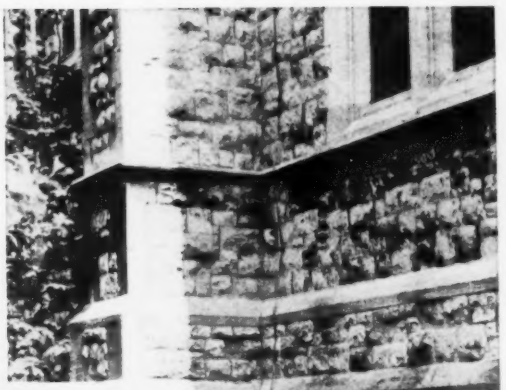
FOR BETTER CONSTRUCTION... SAFER MAINTENANCE

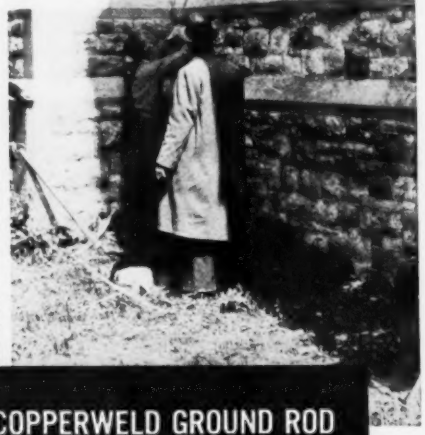
Specify Kearney Products

Plants at: **ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA**

Dug up in an old English churchyard after 25 years' service







—COPPERWELD GROUND ROD
still good for many
more years of use

Copperweld Ground Rods never die—they don't even fade away. They go right on protecting your overhead lines and equipment, year after year, after year.

A company in England, specializing in lightning protection, recently exhumed a Copperweld Ground Rod put into service in 1935 to protect St. Matthews Church near London. When originally installed, this ⅝" x 8-foot rod had a resistance reading of 10 ohms—and when dug up and examined, the rod was in perfect physical condition—ready for many more years of use.

For dependable, long-lasting grounds use Copperweld—the only ground rods with a thick copper covering inseparably molten-welded to a strong steel core. They provide stiffness for easy driving and rust resistance for long life. Copper-to-copper contacts throughout assure low resistance. For your protection, each rod is stamped "Copperweld."

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION *Glassport, Pa.*
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, N.Y.

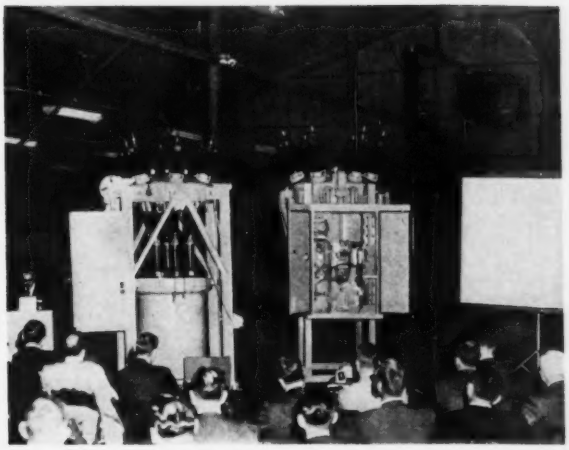
Copperweld®

ground rods

the only ground rods with the **Molten-Weld**

This microphotograph of the Molten-Weld shows how the grains of copper and steel interlock to form a permanent, continuous weld.

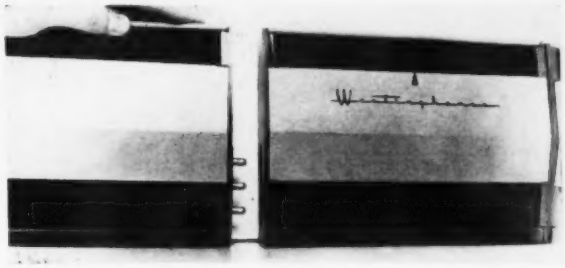
For phone number of closest representative see advertising index in back of book.



New Line Introduced in the West

(6) *Kelman Power Circuit Breaker Division, I-T-E Circuit Breaker Co., 1667 N. Main St., Los Angeles 12, Calif.*

A new line of oil circuit breakers was introduced by I-T-E at its national sales meeting in Los Angeles. Called Trend-line, the new breakers incorporate all three phases of a high-voltage current (up to 46,000 v) into one oil tank. Use of one tank instead of putting each phase into a separate tank is trend making for U. S. utilities, though similar designs have been used in Canada and Europe, according to A. E. Mackenzie, vice president of I-T-E's power equipment divisions, who stated that the new design will bring economies in space and maintenance.



Baseboard Heating Equipment

(7) *Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.*

A new line of baseboard electric heating equipment uses modular plug-in sections to cut installation time. Although more compact than previous baseboard models, these units provide the same output—250 w per lin ft—while the surface is comfortable to touch, according to the manufacturer.

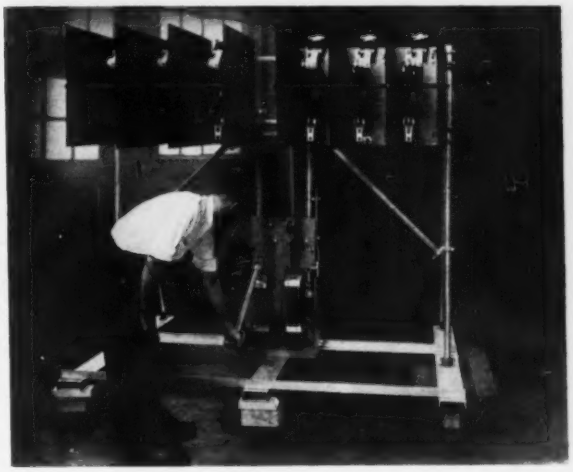
The plug-in feature simplifies installation since electrical connections are required at one point only, in the control section. Additional sections are installed by plugging-in to the control section through a concealed three-pronged connection. This double-male grounded plug provides continuous flow of power to each section. The units are easily fastened to the wall to complete the installation, it is stated.

One standard 2-ft length is available. This eliminates the need for stocking a number of baseboard sizes. In addition, the line includes a new universal corner section for either an inside or outside corner.

The control section is 9½ in. long; electrical connections to it can be made either from the bottom (floor) or back (wall). It includes a combination double pole switch and bellows—activated thermostat that maintains required temperatures within 2 F. A single knob permits thermostatic adjustment over a range from 50 to 90 F.

Each section is equipped with new thermal safety protection. If air flow through the section is blocked causing the unit to overheat, the section will shut off automatically. It will turn on again when the unit cools and stay on provided the obstacle is removed.

The end of each section is one piece, made entirely of plastic designed to accommodate the connecting terminals. Each section has an output of 500 w, and is available with a choice of 120, 208, 240 and 277 v.



Automatic Mechanism

(8) *Delta-Star Electric Division, H. K. Porter Co. Inc., 2437 Fulton St., Chicago 12, Ill.*

This dual cylinder, double throw automatic switch transfer mechanism, activated by stored energy, was designed for areas in which an extended service interruption could be disastrous.

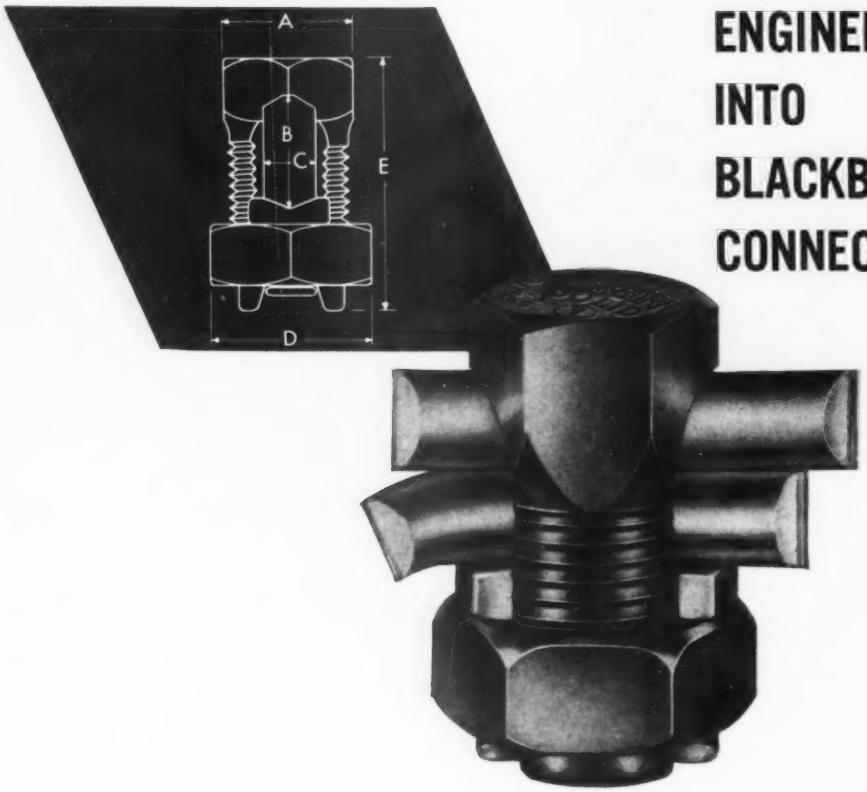
The mechanism opens the preferred source disconnect switch and closes another to transfer instantly to an emergency power source when power failure occurs.

The cylinder for the preferred switch is activated by loss of preferred source voltage. A timing device selects from 0 to 30 seconds time delay to allow circuit breakers to operate properly before triggering the preferred cylinder.

When the preferred switch is opened, a signal is immediately relayed to the second cylinder to close the emergency switch and cut in the emergency power source without interruption of service.

The mechanism offers selectivity so the preferred line may be designated as either of two sources, the manufacturer states.

For More Product Information Fill in Coupon on Page 127



ENGINEERED INTO BLACKBURN CONNECTORS...

REUSABILITY!

The big difference in Blackburn connectors starts with the way they are made. The basic material is high strength duronze, a silicon bronze alloy stronger than many structural steels.

High percentage of threads, both bolt and nut, plus proper selection of materials, reduces friction, increases thread efficiency and clamping force—clamping force is maintained on the conductors. Blackburn's strict inspection assures uniform high quality.

Blackburn connectors give better performance electrically. The greater thread efficiency provides a high clamping force that helps break through oxides on the conductor and improves conductivity. This high initial conductivity is maintained permanently.

Because of the better materials, precision workmanship and careful inspection, Blackburn connectors are reusable . . . over and over. Write for samples.

LIVE BETTER ELECTRICALLY

Jasper
BLACKBURN
Corporation

1525 Woodson Road • St. Louis 14, Mo.

For phone number of closest representative see advertising index in back of book.

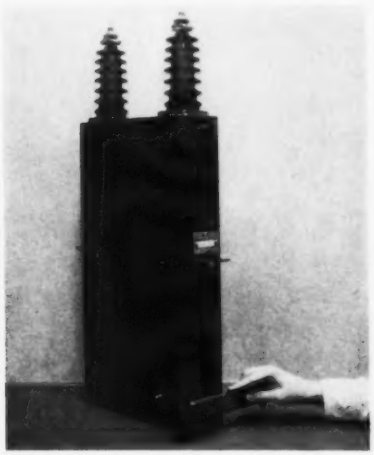
Motor Control Centers

(9) *Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.*

Motor control centers with bus capacity from 200 to 2,000 amp for voltages from 110 to 600 are now available from this manufacturer. The centers, said to offer improved operation, easier maintenance and increased versatility over individual units, are used to control electrical loads such as motors, lighting, welding and heating in industrial plants and commercial buildings.

Available either as fusible or circuit breaker combination units, the control centers consist of two or more starters fed from a common bus and are often attached to transformers or switchgear to form a unit substation. Substations can be purchased as a complete package or as individual units. All control compartments of like size are interchangeable anywhere in the control panel.

Features listed by the manufacturer include: reduced engineering and installation cost; savings in floor space up to 33%; versatility of unit through plug-in design; only one main circuit breaker needed for one center; neatness of arrangement, equipment being centralized rather than spread out.



Capacitors

(10) *General Electric Co., Schenectady 5, N. Y.*

Claimed to be the lightest, smallest 50-kilovar capacitor, the Compact Isokraft 50 is an 82-lb unit. Weight and volume savings were made without reducing effective cooling area because height and width dimensions are identical to those of the former unit, the manufacturer states. Because the distance between the mounting holes is NEMA standard 15⅝ in., the new units are suitable for installation in any NEMA standard capacitor hangers or racks.

Distribution Panelboard

(11) *Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J.*

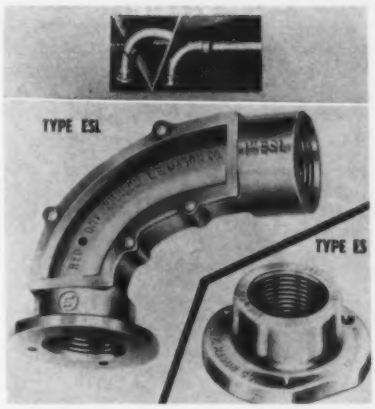
Designed for use with the manufacturer's Stab-lok circuit breakers, the new NALP distribution panelboard protects lighting and power circuits with ratings up to 600-amp main bus and 100-amp branch circuits.

According to the manufacturer, a typical application could consist of an NALP panelboard fed from a 600-amp service with six 100-amp, three-pole breakers, each breaker serving as the disconnect as well as the overcurrent protection for a 20-circuit lighting panel.

Quick Disconnect

(12) *National Carbon Co., Division of Union Carbide Corp., 30 E. 42nd St., New York 17, N. Y.*

Designed to facilitate brush replacement on electric utility equipment, a quick-disconnect terminal assembly for brushes is being tested by equipment manufacturers. The assembly consists of a stationary clip easily bolted to the machine, into which either one or two terminals can be snapped. All parts are silver-plated beryllium copper for minimum resistance the manufacturers announcement states.



Fittings

(13) *L. E. Mason Co., Boston 36, Mass.*

Designed to eliminate need for cutting holes through plywood deck panels, Electro-Serts are said to offer advantages in simplification and labor saving. According to the manufacturer, these fittings provide positive means of fastening conduit to the deck before reinforced concrete slabs are poured. Firmly secured by wood screws or by toe-nailing, the fitting is said to assure a truly vertical threaded insert embedded flush in the concrete ceiling after plywood panel forms are dropped. Standard-length drops are then installed from a standing position on the floor. Two sizes are available, each accommodating a range of conduit sizes: type ESL, a sweep-ell design eliminating field bending of conduit and for use in slabs 4 in. thick or more; type ES, a flange design for use where slab thickness is deep enough and the contractor wants to do his own bending.

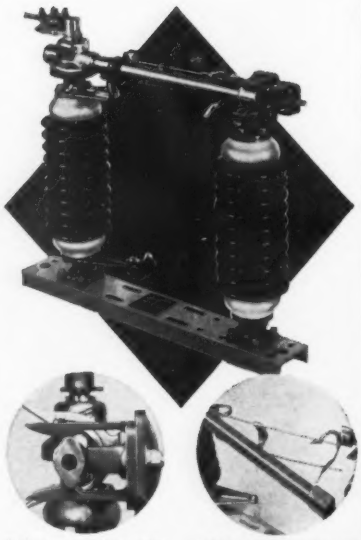
TECO two insulator air break switch gives you three insulator performance . . . *at far less cost*

High-pressure beryllium contacts, essential for good conductivity, are at all switch blade disconnecting points. Uncaming of blade prior to opening releases and wipes contacts easily and positively — even under severest icing conditions. Pivot points are absolutely ice proof.

Only the TECO two insulator switch has double spring type arcing horns which can interrupt charging currents on lengthy 69 KV lines and light transformer loads.

ECONOMY: You save approximately one-third the original cost, as compared to three insulator switches.

The TECO Type 1-D two insulator switch, available in 15 KV through 161 KV, has many other quality switch features that let you use it wherever you're now using three insulator switches.



High pressure wiping action of the beryllium contacts during caming maintains new equipment conductivity even after years of service. One-piece contact eliminates corrosion between bolted areas.

Double arcing spring reduces current value at time of opening, thereby reducing ionization and accomplishing arc interruptions faster.

WRITE TODAY FOR BULLETIN 701.

TURNER ELECTRIC CORPORATION
9510 ST. CLAIR AVENUE • E. ST. LOUIS, ILLINOIS

Complete line of Air-Break Switches—Flexi-Band and Thru-Bolt Cluster Transformer Brackets—Dead-End Band Brackets

ARE YOU SATISFIED?
With Your Job—But Not With Your
FUTURE?

Then read further: Have you a background of electrical operations and line construction? Do you think you can sell? Are your willing to travel? A small progressive manufacturer whose products are leaders in their field used by power and telephone companies has an opening in the Southwestern States which include California, Arizona, Utah, and Nevada with headquarters in or about the metropolitan area of Los Angeles for an industrious and aggressive sales engineer. Salary, Expenses and incentive bonus. Also many company benefits. If this interests you write for details.

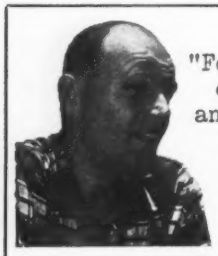
Box 312, Electrical West
68 Post St., San Francisco 4, Calif.

ARE YOU RECEIVING
ELECTRICAL WEST
ON A ROUTE SLIP?

Why not be receiving your own copy? You can have it sent directly to your home where you have more time to read.

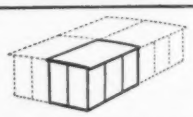
For only $3 you will receive 12 regular monthly issues, plus 12 Mid Month Newsletters and the annual Buyers Guide & Directory.

Just put your name, residence address, title and company on a post card and mail to: Electrical West, Circulation Dept., 68 Post St., San Francisco 4, Calif.



"For a combination electrical field office and storage shed that's quick to move on and off the job, I like Porta House. We have them on several jobs."

Just telephone Porta House collect and get immediate delivery. Prefabricated, bolted, waterproof plywood panels—can be moved on a pick-up truck.



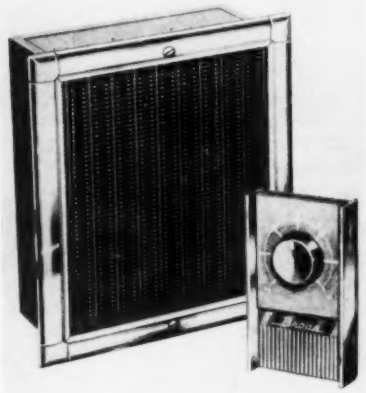
SIZES 6' OR MORE BY 9' OR MORE.

PORTA HOUSE
Ridgely K. Dodge 6767 Broadway Terrace, Oakland, Calif.
Phone collect for immediate delivery: OLympic 2-7237

Weatherproof Swivel

(14) *Ward Engineering Co., 6439 San Fernando Road, Glendale 1, Calif.*

A new swivel is designed for both indoor and outdoor use. The device may be screwed directly into a knockout hole or box. The light may be directed at any angle and locks in position by use of a thumbscrew. Available in chrome or hammertone finish.



Wall Thermostat

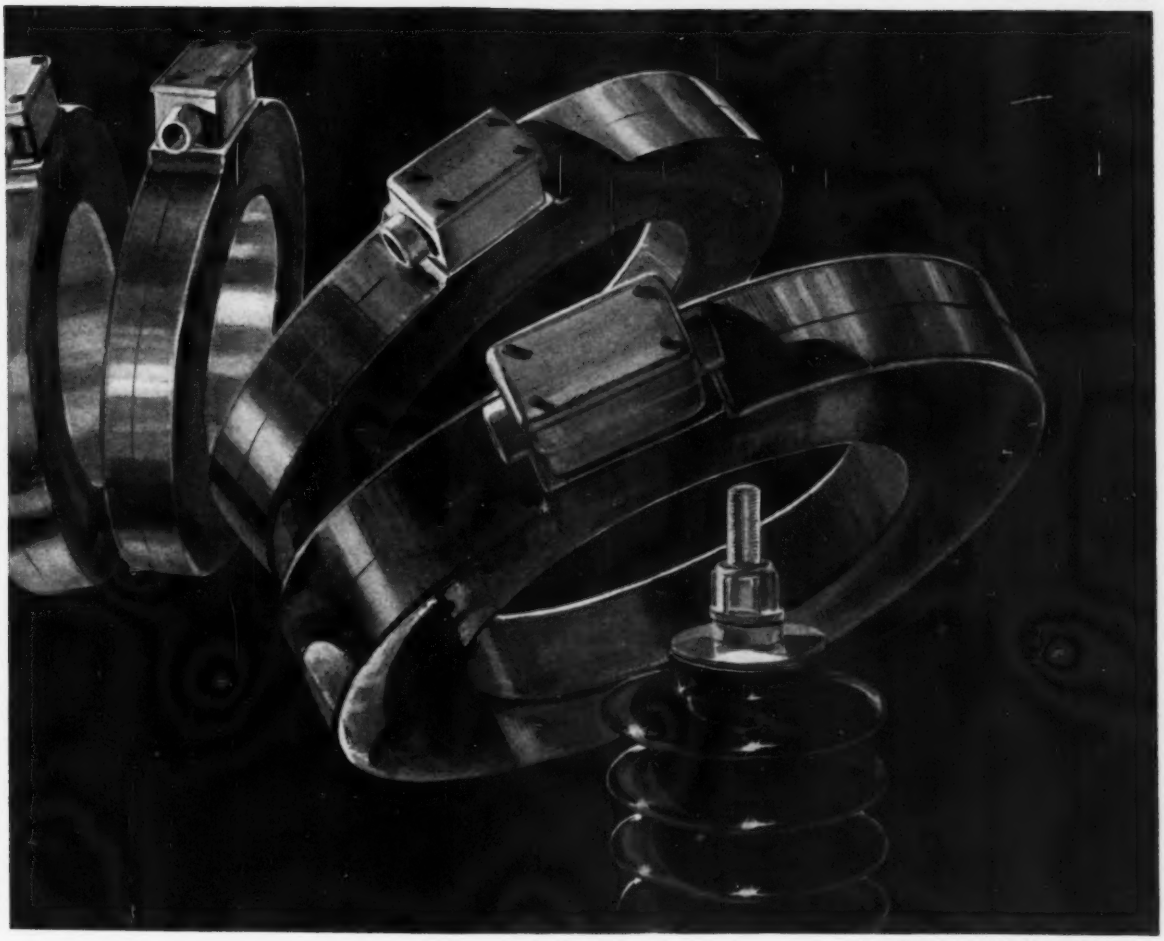
(15) *Broan Mfg. Co., Hartford, Wis.*

A wall thermostat teamed with an electric wall heater has been announced by this manufacturer. The company claims that it is a very sensitive, accurate unit, designed so that it is fully exposed to room air temperature. Any one-half degree change is immediately felt and the operation of the heater is instantaneous, it reports. Warming heat can be felt within 10 seconds of the switch-on.

(16) Fusible Power Pedestals – Designed primarily for use with Transclosures and Pad-Mount transformers in underground distribution systems, they are said to facilitate aboveground connection of buried secondary services and mains. Flexibility, simplicity and economy are three outstanding features claimed. They accommodate eight 2/0 service conductors, two 4/0 secondary mains and five 2/0 neutral conductors. Terminals accommodate cartridge-type fuses rated through 200 amp. These fuses must be ordered separately. Additional information may be obtained from Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis.

ALLIS-CHALMERS

A-1300



Versaformer is an Allis-Chalmers trademark.

New Versaformer current transformer

installs as easily as tossing rings

Cuts installation time from days to minutes! New *Versaformer* current transformer, for indicating, relaying and protective functions, eliminates untanking and bushing removal with circuit breakers and power transformers. Ends the need for large installation crews and equipment.

Epoxy-resin encased *Versaformer* unit is completely weatherproof! Resistant to salt or acid atmosphere. Never needs painting. The complete *Versaformer* current transformer package includes a junction box for immediate conduit hook-up. Sizes: from 400/5 through 1200/5 amps. (Relaying accuracy: 10L200 for 400/5-amp rating.)

Get all the facts fast! Contact your nearby A-C office or **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wis.

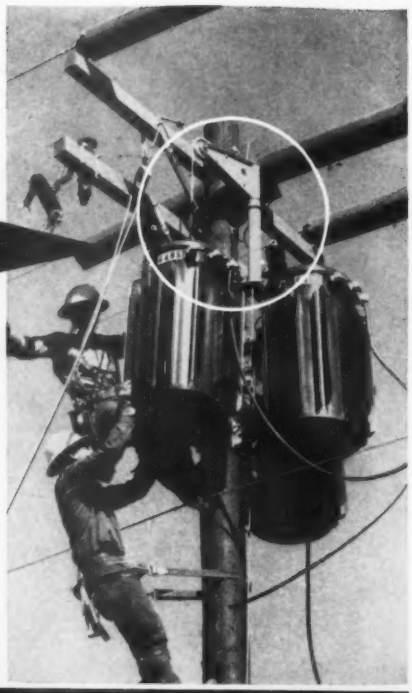
Hook up new Versaformer current transformer without removing power transformer or circuit breaker bushings or covers. Available in 12, 16 and 20-inch inside diameters; rugged epoxy-resin case withstands wide temperature variations, severe mechanical shocks.

For phone number of closest representative see advertising index in back of book.

Cut costs...
Provide greater safety
with a MO PE CO
Transformer Hoist

- One position base mounting
- Swivel head permits multiple mounting
- Lightweight 2 piece portable unit (42 lbs.)
- Assembles easily at top of pole
- Tested at 3000 lbs. lift on cable
- Uses steel cable or manila rope

Save time with the MoPeCo hoist. You can install 3 transformers in only 30 minutes!



Order through your favorite distributor

Write or call
MORRISON-PELSUE CO.
Denver, Colorado
2001 So. Bannock St. RAce 2-2834

Load-Break Device

(17) *General Electric Co., Schenectady 5, N. Y.*

A gas load break device said to provide more efficient load-switching for open dropout fuse cutouts has been introduced by G-E's Lightning Arrester and Cutout Section.

Designed to meet the utility's need for safety and reliability, the new load-break cutouts find application as low cost switching mechanisms on branch and feeder circuits and capacitor and transformer banks, the manufacturer says.

A small, replaceable gas filled monel cylinder positioned in the fuseholder's upper contact makes each open-type cutout a load-break switch. As the cutout is opened, the cylinder tip is the last part of the fuseholder to leave the upper contact. The load current arc, drawn between the cylinder tip and the upper contact, burns the cylinder tip and releases a jet of compressed insulating gas that extinguishes the arc.

The new gas load break feature has been incorporated into G-E's complete line of open dropout cutouts, is available in both 7.8- and 15-kv heavy duty and extra heavy duty fuseholders rated 100 amp and in disconnect blades rated 200 amp.

Dimswitch

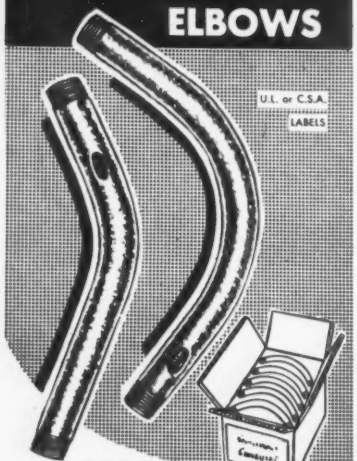
(18) *Slater Electric & Mfg. Co. Inc., 45 Sea Cliff Ave., Glen Cove, Long Island, N. Y.*

Slater Electric & Mfg. Co. is exhibiting its HI-LO Dimswitch, electronic lighting control providing intensity to meet the mood or occasion. It is suitable for use in homes, hospitals, factories and commercial establishments. Three switching positions—bright, soft and off—are provided for situations where low-cost intensity control is desirable, the announcement mentions.

The unit uses electrical current in relation to the amount of lighting selected. Bulb life, it is stated, is increased up to 20 times when the Dimswitch is set for 30% intensity. Models are available for installation in place of existing wall switches, with no additional wiring required. Other models are designed for table tops to control lamps.

(19) STRINGING BLOCKS — Distribution and High-Line Specialties Co., 2100 Del Norte, St. Louis 17, Mo., is offering a data sheet on two new items: stringing blocks with rubber-lined sheave groove; and universal cable stringing blocks with non-metallic molded spools.

Standard Radius
RIGID Conduit
ELBOWS



IN STOCK
½" to 6" sizes • 45° and 90°
ALUMINUM • BLACK ENAMELED
HOT DIP GALVANIZED
Also available in wrought iron

CONDUIT NIPPLE MFG. CO.
1455 SPRING GARDEN AVE. PITTSBURGH 12, PA.

for the LONG PULL
use
Y-ER EAS
Wire Pulling Lubricant

Only Y-ER EAS has all these features

- Creamy, non-corrosive lubricant. Never greasy or messy.
- Prevents sticking or setting. Specially helpful on saddles and turns.
- Does not run back on cables.
- Never harmful to hands or clothing.
- Permanently non-harmful to cables or conduit.

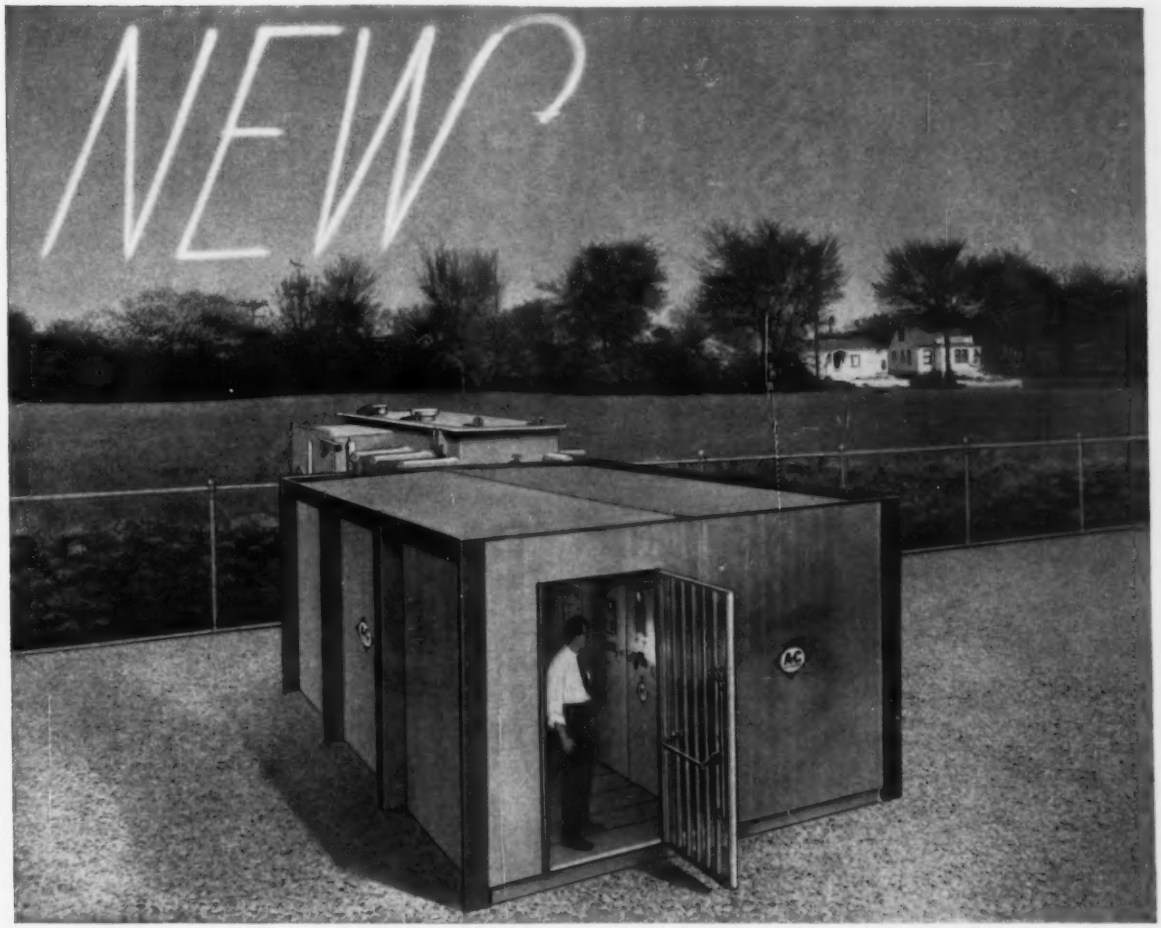
Write for descriptive booklet

GIVES THE SLIP TO—
Lead, Rubber, Braid or Synthetic Covered Cables

At All Leading Electrical Supply Houses

ELECTRO COMPOUND CO.
4148 W. 150th St., Cleveland 35, Ohio

ALLIS-CHALMERS



New Aluma-Clad switchgear combines long-range economy with

styling for the sixties

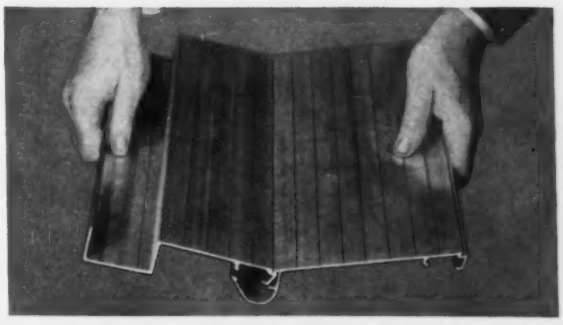
Lasting beauty, long-range economy. You get both with new *Aluma-Clad* switchgear enclosure.

Modern, functional design makes this an innovation welcome in any neighborhood. Ribbed, all-aluminum exterior is soft finished to prevent offensive glare. Color-anodized trim enhances its beauty.

Painting is completely unnecessary! *Aluma-Clad* switchgear can't rust. Its aluminum exterior resists corrosion from salt air and contaminated atmospheres.

Low installation costs! Lightweight aluminum sections dramatically reduce installation time, labor cost. Panels bolt together with aluminum alloy bolts and neoprene gasketing. Because of the unit's light weight and unusual rigidity, simple concrete piers can be used instead of heavy slabs.

Contact your nearby A-C office for complete details on *Aluma-Clad* switchgear, or write **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wis. A-1283

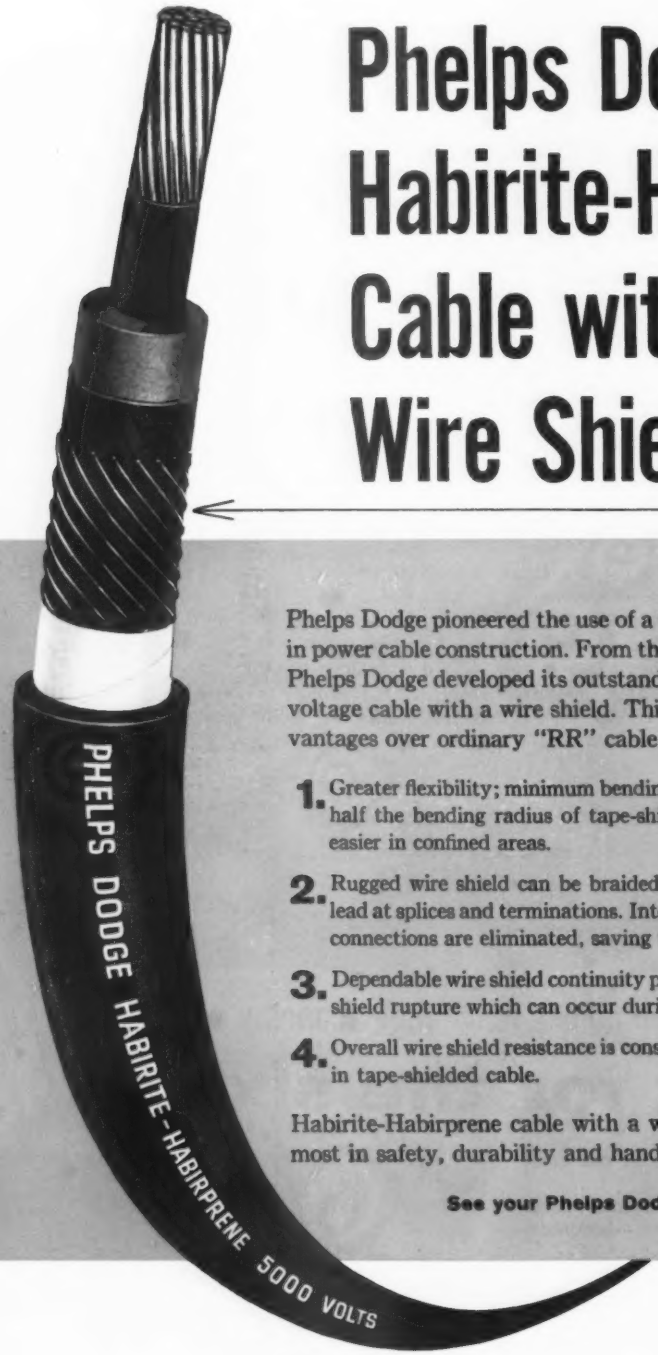


Interlocking modular panels snap together to form a permanent leak-proof joint. Extruded vertical joint sections, every six inches, act as reinforcement — provide exceptional rigidity.

Aluma-Clad is an Allis-Chalmers trademark.

For phone number of closest representative see advertising index in back of book.

For contractors who want the finest . . .



Phelps Dodge Habirite-Habirprene Cable with Wire Shield!

Phelps Dodge pioneered the use of a wire shield as a standard item in power cable construction. From this background and experience, Phelps Dodge developed its outstanding Habirite-Habirprene high voltage cable with a wire shield. This cable offers a number of advantages over ordinary "RR" cable with tape shield including:

1. Greater flexibility; minimum bending radius in most cases is less than half the bending radius of tape-shielded cable, making installation easier in confined areas.
2. Rugged wire shield can be braided or bunched for use as a ground lead at splices and terminations. Intermediate steps in making ground connections are eliminated, saving time and effort.
3. Dependable wire shield continuity provides protection against hidden shield rupture which can occur during installation or in service.
4. Overall wire shield resistance is constant without the variations found in tape-shielded cable.

Habirite-Habirprene cable with a wire shield assures you the utmost in safety, durability and handling ease.

See your Phelps Dodge Distributor!

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, N. Y.

PD

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N.C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N.Y., San Francisco, St. Louis, Seattle, Washington, D.C.

For phone number of closest representative see advertising index in back of book.

Transformers for Underground Systems

(20) *Pennsylvania Transformer Division, McGraw-Edison Co., Box 330, Canonsburg, Pa.*

Lawn-master Pole Star transformer, compartmented distribution transformers for ground-level installation, utilize the same core-and-coil assembly as other transformers in the Pole Star line. Single-phase and three-phase ratings are available.

According to the company, these transformers are designed for service on underground distribution systems. Installation costs for the ground-level units are said to be substantially less than for transformers placed in underground vaults.

Available ratings include 25 through 167 kva, single phase, and 75 through 500 kva, three phase, in all standard voltages through 15 kv. Completely self-protected units are available through 100 kva, single phase. Optional equipment includes transfer switches, stand-off insulators and lightning arrester mounting brackets.

New Process

(21) *Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J.*

A new process for manufacturing high-pressure solid silver to solid silver contacts has been developed for use in the FPE line of air disconnect switches. It employs a special rolling procedure claimed to harden coin silver harder than hard drawn copper and is said to prevent galling, permit heavy wiping action and eliminate corrosion under adverse atmospheric conditions.

KILL TWO BIRDS WITH ONE STONE—Fill out this coupon and get back valuable information from as many sources as you indicate.

ELECTRICAL WEST
68 Post St., San Francisco 4, Calif.

Not good after July 1

Please send me, without obligation, the new product information or catalogs

If described in Product News, circle item number

1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19 20 21

If described in advertising, fill in page number

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

NAME ..... **TITLE** .....

COMPANY .....

ADDRESS .....

CITY ..... **ZONE** ..... **STATE** .....

***Please include your company's name and your position, as we cannot ask manufacturers to furnish literature unless you do.**

*Trademark

Fine Fanner Superformed Products

"Superformed* spells S-A-F-E-T-Y to a SAFETY SUPERVISOR"

"We Safety Men must look at any piece of equipment from the *safety* angle.

"Fanner Superforms? Sure, they are safer for our linemen to handle. Not unwieldy . . . no tools required for dead-line application . . . easily controlled with hot-line tools . . . ends are carefully machined to prevent rubber-glove puncturing . . . safer than straight wires and aluminum ribbon."

Everywhere, Safety Engineers, *the men who guard the safety of people*, have a good word for Superforms.

A-1583A

FANNER
*Superformed**
with a
"PROTECTIVE TWIST"

ARMOR RODS . . . Protect long-span T&D lines at supports

LINEGUARDS . . . Protect short-span T&D lines at supports

PATCH RODS . . . Repair damaged conductors

TAP ARMOR . . . Protects conductor at tapping points

FANNGRIPS . . . For dead-ending strands and conductors

FANNSPLICES . . . Join two ends of conductor wire

PLASTIC PRODUCTS . . . For conductor surface protection

FANNER
The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

POWER STATION ENGINEERING AND ECONOMY

Just Published. Here is thorough coverage of modern power generation by thermal and water power stations, with special emphasis on the steam power plant. Chapters on individual types of equipment —steam generators, draft systems, condensers, pumps, water conditioning systems, station controls, and many others—are included. The book also provides essential facts and statistics on the general economic problems confronting engineers; what you should know about investment charges, interest rates, and the like; methods of selecting equipment, evaluating capacity; and much more. **By B. G. A. Skrotzki, Associate Editor, Power; and William A. Vopat, Cooper Union School of Engineering. 751 pp., 387 illus., 81 tables, $12.50**

TRANSFORMERS: For the Electric Power Industry

Explains transformer design, construction, application, operation, and maintenance. Modern developments in temperature calculation, testing, estimation of eddy and stray losses, insulation, gauging the transformer's life span, fault detection, and the economics of transformer design and application are comprehensively covered. **By R. L. Bean, Nicholas Chakan, Jr., H. R. Moore, and E. C. Wentz, all of Westinghouse Electric Corp., Sharon, Pa. 426 pp., 277 illus., $12.50**

HOME WIRING MANUAL

This authoritative book shows you how to meet today's demands for full service, extra capacity, safety, and economy in home wiring systems. Covers methods for determining such essential information as loads, service-entrance feeder size, number and size of branch circuits, and number and type of outlets. Provides a new "three-degree" approach for simplifying the whole job of planning—pointers on low-voltage control—and other aids. **By A. Carl Bredahl, formerly Technical Services Director, Westinghouse Electric Corporation. 221 pp., 97 illus., 38 tables. $4.95**

STANDARD HANDBOOK for ELECTRICAL ENGINEERS

Thousands of facts and figures, systems and measurements, methods and materials from all fields of electrical engineering. Covers everything from electric and magnetic circuits, regulators, and prime movers—to illumination, power system electrical equipment, and electronics. New information on transistor-nuclear power dielectrics for capacitors, synthetic resins and plastics, automation, telemetering, etc. **Editor-in-Chief: A. Knowlton, Consulting Ed., Electrical World, 9th Edition, 2230 pp., 1725 illus., $21.00**

SEE THESE BOOKS 10 DAYS FREE

McGraw-Hill Book Co., Dept. EW-5
327 W. 41st St., N.Y.C. 36

Send me book(s) checked below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep, plus few cents for delivery costs, and return unwanted book(s) postpaid. (We pay delivery costs if you remit with this coupon—same return privilege.)

- ☐ Skrotzki & Vopat—**Power Station Eng. & Econ., $12.50**
- ☐ Bean, et al.—**Transformers: For Elec. Power Industry, $12.50**
- ☐ Bredahl—**Home Wiring Manual, $4.95**
- ☐ Knowlton—**Stndrd. Hndbk. for Elec. Eng., $21.00**

(PRINT)
Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position .....

For prices and terms outside U. S. write McGraw-Hill Int'l, N.Y.C. EW-5

INDEX TO ADVERTISERS AND WESTERN

May 1960

Advance Transformer Co. **49**
Los Angeles ..... LUdlow 5-5591
Los Altos (San Francisco) ..... YOrkshire 8-2176
Portland: Pete Bach Electric ..... CApitol 7-2173
Denver: A. J. Nelson ..... KEystone 4-6751
Medina, Wash.: Lyle Heaton ..... GL 4-8696
Albuquerque ..... CHapel 2-8626

Allen-Bradley Co. **17, 18**
Los Angeles ..... ANgelus 9-9421
San Francisco: Campbell & George ..... MIssion 8-1236
Denver: Young Electric ..... AComa 2-4841
Albuquerque: A & A Supply ..... ALpine 6-0307
Salt Lake City: Stevens Sales ..... INgersoll 7-5489
Phoenix: Edw. P. Weller ..... AMherst 6-3188
Seattle: J. A. Tudor Associates ..... MUtual 2-7444
Portland: J. A. Tudor Associates ..... BEImont 2-1188

Allis-Chalmers Mfg. Co. **123, 125**
San Francisco ..... DOuglas 2-8384
Los Angeles ..... MAdison 6-2231
Phoenix ..... CRestwood 4-5426
Denver ..... CHerry 4-6556
Salt Lake City ..... EMpire 3-1723
Portland ..... CApitol 2-9835
Seattle ..... MAin 4-3737

Anaconda Wire & Cable Co. **56**
San Francisco ..... YUkon 6-0051
Los Angeles ..... MAdison 6-2371
Denver ..... AComa 2-0616
Seattle ..... MAin 3-4686
Salt Lake City ..... ELgin 5-3401

Blackburn Corp., Jasper **120**
San Francisco: Donald E. Ingalls ..... JUniper 6-0332
Los Angeles: Robert M. Schow ..... HUbbard 3-7931
Vancouver, Wn.: Wm. A. Horning ..... OXford 4-4475
Phoenix: W. C. Osborn ..... WIndsor 3-1815
Denver: Sales Engineers Co. ..... AComa 2-4893
Salt Lake City: Sales Engineers (James D. Stephens) ..... EMpire 3-7402

Brown Boveri Corp. **33**
Portland ..... CApitol 3-7234
San Francisco: Bellilove Co. ..... YUkon 2-3713
Pasadena: A. B. Smedley ..... SYcamore 8-1174
Denver: Slaybaugh-Thompson Co. ..... AComa 2-5826
Tucson: Central Station Equip. Co. ..... MAin 3-2493

BullDog Electric Products Div., I-T-E Circuit Breaker Co. **1, 94, 95**
Oakland: Safety Switchboard Co. ..... LOckhaven 2-4945
Los Angeles: BullDog Elec. Products of L. A. ..... ANgelus 9-8101
Portland: Coast Elec. & Mfg. Co. ..... ATlantic 8-5373
Denver: Young Elec. & Mfg. Co. ..... AComa 2-4841

Carol Cable Co., Div. Crescent Co., Inc. **5**
San Francisco: F. M. Nicholas ..... YUkon 2-1964
Los Angeles: Payne & Sloan, Inc. ..... MAdison 4-7317
Seattle: Bruce-Emmett Co. ..... MUtual 2-6737
Portland: Bruce-Emmett Co. ..... BEImont 2-8117

Chance Co., A. B. **99**
San Francisco ..... MIssion 7-1300
Seattle ..... MUtual 2-8920
Portland ..... CApitol 8-3866
Los Angeles ..... LUdlow 2-1090

Chase-Shawmut Co. **129**
Garnett Young & Co. following Cities:
San Francisco ..... DOuglas 2-4220
Los Angeles ..... ADams 1-4337
Seattle ..... MAin 3-0123
Portland ..... CApitol 8-8478
Phoenix ..... BRidge 5-7826
Denver: Allen B. Carpenter ..... KEystone 4-0283

Circle Wire & Cable Co. **35**
Sub. of Cerro de Pasco Corp.
San Francisco: Brill Electric Sales ..... SUtter 1-7547
Los Angeles: Elkins Electric Agency ..... ANgelus 8-3385
Seattle: Electric Agencies ..... MAin 3-2360

Classified **122**

Clifton Conduit Div. General Cable **28**
San Francisco: The Baxter Co. ..... MArket 1-8636
Los Angeles: Michel Bros. ..... AXminster 2-9191
Seattle: Northwestern Agencies ..... MAin 3-8882
Portland: Northwest Sales Co. ..... CApitol 3-5959

Conduit Nipple Mfg. Co. **124**
San Francisco: George Gray ..... HEmlock 1-1526
Los Angeles: Hayjax Co. ..... MAdison 8-5256
Denver: Reitz Sales ..... EAst 2-6200
Portland: Pacific Electric Sales ..... BEImont 5-4137

Copperweld Steel Co. **118**
San Francisco ..... DOuglas 2-6979
Bellevue, Wash. ..... GLencourt 4-1233

Duncan Electric Co., Inc. **30**
Covina, Calif: C. C. Blacksmith ..... EDgewood 2-2150
Reno: Kitchen Elec. Supply Co. ..... FAirview 2-4533
Albuquerque: A & A Supply ..... ALpine 6-0307
Phoenix: W. H. Eddy Elec. Prod. Inc. ..... ALpine 2-6322
Billings: Montana Elec. Supply ..... Phone: 2-0528
Denver: Hamilton Associates ..... CHerry 4-1505
Shaffer & Nelson, Inc. in following cities:
Seattle ..... MUtual 2-0186
Portland ..... BEImont 4-7437
Spokane ..... FAirfax 7-9528
Salt Lake City ..... ELgin 5-8304

du Pont de Nemours & Co., E. I., Elastomer Chem. Dept. **38**
Los Angeles ..... LUdlow 2-6464
San Francisco ..... DAvenport 6-7550
Seattle ..... MElrose 2-6977
Portland ..... CApitol 7-1281
Denver ..... AComa 2-2347
Salt Lake City ..... EMpire 4-3582

Electro Compound Co. **124**
Los Angeles: Golsan Co. ..... RIchmond 7-5486
Portland: Oregon Mfg. Agents ..... Capitol 6-3971
Denver: R&M Sales ..... Spruce 7-2515
San Francisco: Electrical Sales Co. ..... EXbrook 7-2087

Fanner Mfg. Co. **25, 16, 127**
San Francisco: Sold Through Line Material Industries ..... PLaza 5-8600
Los Angeles ..... RAymond 3-6251 and OXford 5-2260
Phoenix ..... ALpine 4-8471
Denver: Slaybaugh & Thompson ..... AComa 2-5826
Portland: A. L. Polich, Inc. ..... CApitol 3-6241
Seattle: A. L. Polich, Inc. ..... WE 2-9011

Federal Pacific Electric Co. **36, 37**
San Francisco ..... ATwater 2-0810
Los Angeles ..... CLinton 7-8281
Seattle ..... ATwater 3-7801
Oswego, Ore. ..... NEptune 6-4573
Salt Lake City: James Stephens Co. ELgin 5-3540
Denver: R. D. Florence Co. ..... AComa 2-1573
Hamilton Associates ..... CHerry 4-1505
Albuquerque: F. W. Gorman ..... CHapel 7-1596
Phoenix: Elec'l. Eng. & Sales Corp. ..... ALpine 3-0927

Fisher-Pierce Co. Inc. **92**
San Francisco: Maydwell & Hartzell ..... ATwater 8-6900
Los Angeles: Maydwell & Hartzell ..... MAdison 8-7245
San Diego: Maydwell & Hartzell ..... CYpress 6-2245
Phoenix: Maydwell & Hartzell ..... ALpine 2-5858
Seattle: Oscar Hogenson ..... MAin 2-0737
Portland: J. A. Tudor Asso. ..... BEImont 2-1188
Denver: Allen I. Williams ..... MAine 3-0343

Fullman Mfg. Co. **106**
San Francisco: L. F. Church ..... UNderhill 1-2840
Los Angeles: Payne & Sloan ..... MAdison 4-7317
Denver: Harvey Olmstead ..... TAbor 5-6264
Bellevue, Wn.: R. C. English ..... GL 4-0566
Portland: Wiant Products ..... CApitol 7-2671

G & W Electric Specialty Co. **34**
San Francisco: C. E. Ingalls Sons ..... GArfield 1-2916
Los Angeles: R. E. Cunningham & Son ..... MAdison 8-1105
Seattle: W. R. Hendrey Co. ..... MAdison 3-3968
Salt Lake City: Riter Engineering Co. ..... EMpire 3-7933
Denver: H. C. Guire Co. ..... SPruce 7-2864
Albuquerque: Frank W. Gorman ..... CHapel 7-1596

(Continued on page 129)

SALES OFFICES

General Electric Co.
Schenectady, Apparatus Div. 26, 27, 46, 47, 54, 55, 58, 59, 102, 103
San Francisco ..... DOuglas 2-3740
Los Angeles ..... MAdison 5-7381
Phoenix ..... ALpine 8-7724
Denver ..... KEystone 4-7171
Boise 4-3021
Salt Lake City ..... EMpire 4-1891
Portland ..... ATwater 8-0281
Seattle ..... MAin 4-8300

General Electric Co. Insulator Div. ... 88, 89
Burlingame, Calif. ..... DIamond 4-5757
Portland ..... BEImont 4-0233
Denver ..... GEnesee 3-5511

Graybar Electric Co. Inc. 60, 61
San Francisco ..... MArket 1-5131
Los Angeles ..... ANgelus 3-7282
Phoenix ..... ALpine 2-2371
Denver ..... TAbor 5-7111
Boise ..... BOise 3-2594
Butte ..... BUtte 3233
Portland ..... ATlantic 8-5661
Seattle ..... MUtual 2-0123
Salt Lake City ..... ELgin 9-8771
Spokane ..... FAirfax 7-6611
Tacoma ..... MArket 7-0164
San Diego ..... BEImont 3-1361
Tucson ..... MAin 2-6439
(Sales offices in all principal cities)

Hill Transformer Works ..... 4th Cover
Delta-Star Electric Div., H. K. Porter Co. Inc.
San Carlos ..... LYtell 1-4461
Albuquerque: Ralph B. Black ..... ALpine 5-9625
Los Angeles ..... MAdison 6-5651
Phoenix:
Daley Elec. Sales Co. Inc. ..... ALpine 2-2326
Salt Lake City:
Stevens Sales Co. ..... INgersol 7-5489
San Francisco ..... GArfield 1-2916
Seattle ..... MAin 4-7066
Tucson: Daley Elec. Sales Co., Inc. AXtel 5-5378

Hotpoint Co., Div. G. E. Co. 39
San Mateo-San Francisco ..... DIamond 2-5591
Los Angeles ..... MAdison 4-9201
Seattle ..... MAin 3-8340
Portland ..... CApitol 6-3776
Denver ..... KEystone 4-0131

Hubbell, Inc., Harvey 57
San Francisco ..... Mission 7-3240
Los Angeles ..... MAdison 8-7226
Denver: Paul A. Douden ..... KEystone 4-6798
Spokane: Elmer Johnson ..... MAin 2518
Seattle: Frank A. Strohecker ..... MAin 3-0357
Portland: David King ..... CApitol 8-1990

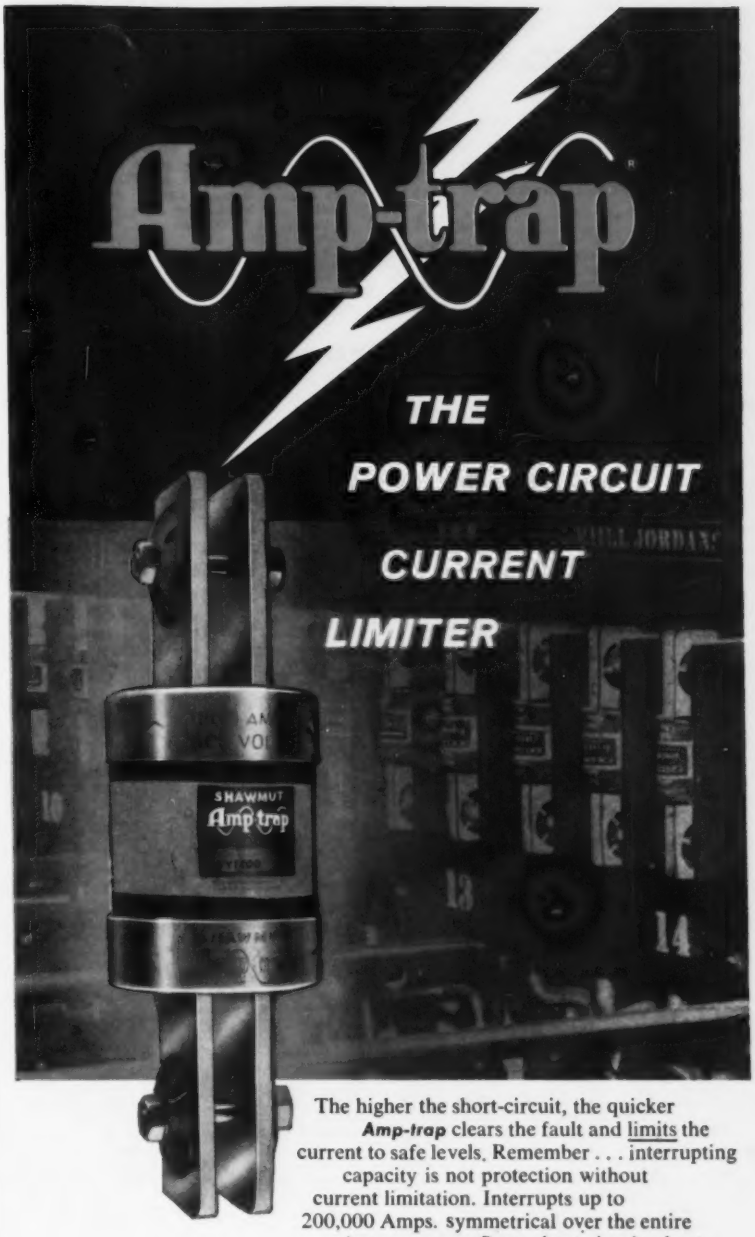
Indiana Steel & Wire Co. Inc. 2
(Distributed by Graybar, all branches)
San Francisco ..... MArket 1-5131
Los Angeles ..... ANgelus 3-7282
Portland ..... ATlantic 8-5661
Seattle ..... MUtual 2-0123
Denver ..... TAbor 5-7111
Salt Lake City ..... ELgin 9-8771

International Business Machines 62
Los Angeles ..... DUnkirk 1-3696
San Francisco ..... YUkon 2-0100
Denver ..... AComa 2-9373
Seattle ..... MUtual 2-4640
Portland ..... CApitol 8-6623
Salt Lake ..... ELgin 9-7721

I-T-E Circuit Breaker Co. 44
South San Francisco ..... PLaza 6-8660
Los Angeles ..... MAdison 2-7134
Denver ..... AMherst 6-1404
Seattle: Garland-Affolter Eng. Corp. ..... MUtual 2-4950
Portland: Garland-Affolter Eng. Corp. ..... CApitol 3-7349
Salt Lake City: Riter Eng. Co. ..... INgersol 7-9449
Butte: McDonough, R. E. ..... BUtte 2-5447
El Paso: R. L. Brewer Co. Inc. ..... KEystone 2-7651
Tucson: Central Station Equip. Co. ..... MAin 3-2493

Kearney Corp., James R. 116, 117
Maydwell & Hartzell, Inc., in following cities:
San Francisco ..... ATwater 8-6900
Los Angeles ..... MAdison 8-7245
Seattle ..... MAin 4-2368
Portland ..... CApitol 8-4173
Spokane ..... MAdison 4-3285
Phoenix ..... ALpine 2-5858
San Diego ..... CYpress 6-2245
Salt Lake City: Conely Engineering Co. ..... EMpire 3-5013
Golden, Colo.: Robert C. Smith ..... CRestview 9-5279

(Continued on page 130)



The higher the short-circuit, the quicker ***Amp-trap*** clears the fault and limits the current to safe levels. Remember . . . interrupting capacity is not protection without current limitation. Interrupts up to 200,000 Amps. symmetrical over the entire Ampere range. Stops short circuits short. Anticipates and prevents destruction before it can occur. Faster than any ordinary fuse.

Use ***Amp-trap*** on all general power circuits, DC circuits, Networks, Entrance Switches, Busways, etc. Be safe, not sorry — ask for, get and install ***Amp-trap.***

There is one for every purpose. Write today.

Amp-trap® – *"Awake At The Switch"*

THE CHASE-SHAWMUT CO.

374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

Subsidiary of I-T-E CIRCUIT BREAKER CO.

© The Chase Shawmut Co. 1960

INDEX TO ADVERTISERS AND WESTERN SALES OFFICES

May 1960

(Continued from page 129)

Kelman Power Circuit Breaker Div. 29
I-T-E Circuit Breaker Co.
Los Angeles CApitol 5-1521
San Francisco:
C. E. Ingalls & Sons GArfield 1-2916
Seattle: Eicher & Co. ATwater 4-1811
Salt Lake City: Cline Equip. Co. ELgin 5-3814
Phoenix: W. H. Eddy Elec. Prod. Inc. CRestwood 4-4032
Denver: I-T-E Circuit Breaker Co. AMherst 6-1404
Butte: R. E. McDonough Butte 2-5447

Kerite Co. 20
San Francisco GArfield 1-2916
Glendale Calif. CHapman 5-3721
Seattle: Fred Carlson ATwater 4-4360

Klein & Sons, Mathias 93
Glendale, Calif. Citrus 3-3523
Sunnyvale, Calif. CHestnut 5-2310

Lapp Insulator Co. Inc. 3rd Cover
San Francisco: Donald E. Ingalls JUnesu 6-0332
Los Angeles: Earl S. Condon & Co. DUnkirk 1-3951
Seattle: Charles F. James MAdison 3-1531
Salt Lake City: Riter Engineering Co. EMpire 3-7933
Butte: R. E. McDonough Co. 2-5447
Albuquerque, N. M.: Smith Sales Co. AXtel 9-8024

McCabe Powers Auto Body Co. 3
Berkeley LAndscape 4-4416
Portland BElmont 6-1178
Pomona NAtional 4-6464
Phoenix BRidge 5-5774
Salt Lake City DAvis 2-5658
Spokane FAirfax 5-2591
Los Angeles RIchmond 9-3424

McGraw-Hill Book Co. 128

Micro Balancing, Inc. 52
Joslyn Pacific in following cities:
Los Angeles LUdlow 7-4251
San Francisco UNderhill 1-7313
Seattle MAin 3-1957
Portland CApitol 3-5127
Phoenix ALpine 2-1245
Salt Lake City EMpire 3-2084
Denver: Hamilton Assoc. CHerry 4-1505

Moloney Electric Co. 22
Sales Offices in following cities:
San Francisco EXbrook 7-1800
Los Angeles MAdison 4-1864
Portland CApitol 3-7349
Seattle MUtual 2-4950
Denver: Hamilton Associates CHerry 4-1505
Salt Lake: Riter Engineering EMpire 3-7933

Morrison-Pelsue 124
Denver RAce 2-2834
North Hollywood: A. F. Johnson STate 7-8544
Salt Lake City: W. H. Pingree Co. EMpire 3-6731
San Francisco: Brenton Equip. Co. EXbrook 2-8185
Los Angeles: Golsan Co. RIchmond 7-5486
Spokane: Tinling & Powell TEmple 8-8276

National Electric Div., H. K. Porter Co. Inc.
(See H. K. Porter Co. Inc.)

National Supply Co., Tubular Products Div. 31
San Francisco, Branch office DOuglas 2-2975
San Francisco: Arthur & Allen YUkon 2-3483
Los Angeles: Murphy-Hain ANgelus 8-3521
Denver: Fred E. Staible & Sons TAbor 5-3991
Salt Lake City:
Fred E. Staible & Sons INgersol 6-2461
Seattle: J. H. Stumph MUtual 2-5232

Orangeburg Mfg. Co. Inc. 87
General Electric Supply and Graybar Electric Co. all principal cities
Santa Ana LIncoln 4-1195
Seattle MUtual 2-4566
Newark, Calif. SYcamore 3-2200

Pacific Gas and Electric Co. 90
San Francisco SUtter 1-4211

Pennsylvania Transformer Div. 6
San Francisco: George E. Honn Co. SUtter 1-7352
Los Angeles: John G. Corrin MAdison 2-0830
Seattle: Fred W. Carlson ATwater 4-4630
Phoenix: Roy E. Coulson WIndsor 3-8935
Denver: Peterson Co. DExter 3-5434
Salt Lake City: Clarence W. Silver ELgin 5-5378
Portland:
Fred W. Carlson & Associates CApitol 8-3798
Boise, Ida.: Clarence W. Silver Co. 2-6947
Albuquerque:
Williamson Sales Co. ALpine 6-6617

Phelps-Dodge Copper Products Corp. 126
San Francisco EXbrook 2-7379
Los Angeles RAymond 3-1311
and PArkview 1-1191
Seattle MAin 3-6790
Denver CHerry 4-9291
and CHerry 4-9292

Porta House 122
Oakland OLympic 2-7237
Sacramento: Robert Cronin GIlbert 3-8543
Portland: Bardi Gen. Contractors PRospect 5-4354
Los Angeles: Constructors Supply Co. LUdlow 3-4158
Los Angeles: Ball & Black ANgelus 9-7586
Santa Ana: Blystone Equip. Co. Kimberly 2-3918

Porter Co. Inc., H. K., National Electric Div. 45
San Francisco UNderhill 1-1145
Los Angeles RAymond 3-4654
Seattle MAin 3-3775
Salt Lake City DAvis 2-2701
Denver PEarl 3-3741

Precision Multiple Controls 104
San Francisco:
C. E. Ingalls & Sons GArfield 1-2916
Los Angeles: Industrial Engineering & Equip. Corp. DUnkirk 1-1281
Denver: Jim Dawson Co. ALpine 5-7194
Salt Lake City:
Leonard M. Slusser ELgin 5-2322
Vancouver, Wn.:
Bill Horning Sales OXford 4-4475

R T & E Corp. 32
Portland MErcury 9-2161
Medford: H. L. Mooney SPring 2-9948
San Jose: N. R. Beebe ANdrews 4-5641
Pasadena: D. B. Cole SYlvan 0-5977
Salt Lake City: T. R. Van Wagoner Co. INgersol 6-2461
Bellevue, Wn.: K. H. DuBois SHerwood 6-4114
Billings: W. L. Lassen ALpine 9-9306
Anchorage: J. P. Bagoy BRoadway 7-8011

Reliable Electric Co. 2nd Cover
Palo Alto, Calif.: D. B. Evans DAvenport 5-0230
Los Angeles: H. C. Mitchell, Jr. GRanite 8-3418
Mercer Island, Wn.: D. J. Smith ADams 2-8378

Republic Steel Corp. 53
San Francisco GArfield 1-0977
Los Angeles MAdison 4-5144
Portland: Shaffer & Nelson Inc. BElmont 4-7437
Seattle: Shaffer & Nelson Inc. MUtual 2-0186
Spokane: Shaffer & Nelson Inc. FAirfax 7-9528
Denver: C. D. Belt Co. SKyline 6-9421

Rome Cable Div. of Alcoa 42, 43
Los Angeles RAymond 3-3631
San Francisco VAlencia 6-3580
Seattle MAdison 4-3017
Salt Lake City ELgin 9-8811
Denver KEystone 4-0533

Royal Electric Corp. 7
Los Angeles: Eckert-Lloyd Co. RIchmond 7-9655
San Francisco: Eckert-Lloyd Co. HEmlock 1-5792
Seattle: Northwestern Agencies MAin 3-8882
Portland: Northwestern Agencies CApitol 7-0434
Phoenix: Wm. Benndorf CRestwood 7-1662
Denver: Hyde Electronics Co. WEst 6-3456

S & C Electric Co. 100, 101
Burlingame, Calif. OXford 7-1130
El monte, Calif.: Randolph Eng. Corp. CUmberland 3-4183 and 3-7901
GIlbert 3-1701
Phoenix: Randolph Eng. Corp. ALpine 8-5281
Salt Lake City:
Riter Engineering INgersoll 7-9449
Seattle: Muth-Richards Co. EAst 3-2128
Portland: Andrew L. Polich, Inc. CApitol 3-6241

Sangamo Electric Co. 50
San Francisco: L. A. Nott HEmlock 1-4738
Los Angeles: (Factory Sales) DUnkirk 7-2336
(Time Switches) ANgelus 8-6771
Seattle: T. R. Wood MAin 3-8204
Denver: Mt. States Machinery CHerry 4-7421
Phoenix: J. E. Redmond Co. ALpine 4-8471
Portland: R. L. Schoenberger CApitol 3-8742
Butte: R. E. McDonough Butte 2-5447
Tucson AXtel 8-4801
Albuquerque:
Gorman Engineering CHapel 7-1596
El Paso: Gorman Engineering KEystone 2-3449

Southern California Edison Co. 48
Los Angeles MAdison 4-7111

Southern States Equipment Corp. 63
Seattle: Jos. C. Platt MAin 3-6141
Salt Lake City: H. Lee Rawlings Co. ELgin 9-8811
Denver: R. T. Lewis Co. EAst 2-1082
Los Angeles: W. E. Kirk Co MAdison 4-3651
Lake Grove, Ore.: C. F. Selby NEptune 6-1486
Oakland: John H. Ormond TWinoaks 3-3235

Subox, Inc. 51
San Francisco: Wrathall & Krusi EXbrook 7-3593
Los Angeles: R. E. Cunningham & Son MAdison 8-1105
Portland: Wm. J. Cottrell & Assoc. CApitol 7-6191
Seattle: Fred H. Carlson Co. ATwater 4-4630
Denver: Ambler Co. TAbor 5-8885

Superior Cable Corp. 24
Maydwell & Hartzell, Inc., in following cities:
San Francisco ATwater 8-6900
Los Angeles MAdison 8-7245
Phoenix ALpine 2-5858
Portland CApitol 8-4173
Seattle MAin 4-2368
Spokane MAdison 4-3285

Texoma Enterprises, Inc. 104
Los Angeles:
Industrial Eng. & Equip. Corp. DUnkirk 1-1281
Portland:
Western Power Products, Inc. CApitol 7-1384
Seattle: Western Power Products, Inc. LA 2-2009

Turner Electric Corp. 122
Fred W. Carlson in following cities
Seattle ATwater 4-4630
Portland CApitol 8-3798
Butte Phone 8916
Los Angeles:
Industrial Eng. & Equip. Corp. DUnkirk 1-1281
Denver: Hamilton Associates CHerry 4-1505

Truck Equipment Co. 105
Los Angeles: Calavar Corp. RIchmond 8-6292
Oakland: Dailey Body Co. KEllog 4-1423
Portland: Schetky Equipment Corp. BEaverton 4-5344
Spokane: Leland Trailer & Equip. Co. KEystone 4-0591
Salt Lake City: W. H. Pingree Co. EMpire 3-6731
San Francisco: Caesar Baldassari EXbrook 7-1303
San Francisco: FWD Pacific Co. GArfield 1-4971
Seattle:
Robblee Utility Equipment Co. MAin 4-1412
Denver:
Rocky Mountain Export Co. MAin 3-7185

Wagner Electric Corp. 64
South San Francisco PLaza 6-0520
El Segundo, Calif. ORegon 8-7671
Portland CApitol 7-3654
Salt Lake City EMpire 3-5013
Denver CHerry 4-7421
Seattle MAin 2-2342

Westinghouse Electric Corp. 40, 41, 96, 107, 108, 109, 110, 111, 112, 113, 114
San Francisco EXbrook 2-5353
Los Angeles MAdison 6-3881
Denver KEystone 4-8121
Phoenix ALpine 8-8621
Salt Lake City ELgin 5-3413
Seattle MAin 2-0808
Portland CApitol 2-9151
Spokane FAirfax 8-3371

LOWEST-COST TRANSMISSION LINE

Armless pole design eliminates crossarms, braces, hardware . . . saves up to one-third in material . . . more in labor of erection. Because insulator is stronger than crossarm, permits longer spans, larger conductors, greater safety margins. Requires narrowest ROW. Easiest-ever for hot-line work.

BEST-PERFORMING TRANSMISSION LINE

Horizontal mounting of Line Post encourages uniform wetting and self cleaning, improves wet flashover values by as much as 15% over upright ratings. Eliminates contamination flashover and pole-top burning.

BEST-LOOKING TRANSMISSION LINE

Neat, unobtrusive appearance avoids customer objection in urban and suburban residential construction. Can handle 69 kv, or higher, yet looks more like a "small" distribution line. Permanently free of RIV and TV interference, too.

the insulator for armless transmission

Lapp Line Posts with clamp-top and integral-base-and-gain for horizontal mounting are available in voltage ratings of 35 kv, 45 kv, 55 kv, 66 kv and 88 kv. Each insulator is held by two through-bolts, and entire structure is easily assembled on the ground before erection.

Lapp

Modern armless construction with Lapp Line Posts is explained in detail in the new Lapp Catalog No. 8. Write for your copy. Lapp Insulator Co., Inc., LeRoy, N. Y.

to serve you better– DELTA-STAR adds western facilities!

The purchase of Hill Transformer Company, Inc., by H. K. Porter Company, Inc., diversified Pittsburgh-based industrial manufacturer, adds important Western manufacturing facilities to its transformer production.

Porter's financial resources, its Delta-Star Division's strengths in research, development and engineering, assure continued product improvement, ability to deliver and guaranteed quality and dependability to Western transformer users.

The Hill organization, formed in the West, knows the needs of growing Western utilities and is intimately acquainted with Western climatic problems. More than ever, **Hill means service to the West.** Hill Transformer Works, Delta-Star Electric Division, San Carlos, California. Sales Offices in principal cities throughout the West.

DELTA-STAR **PORTER** ***ELECTRIC DIVISION***

H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.